Software Architecture by Example

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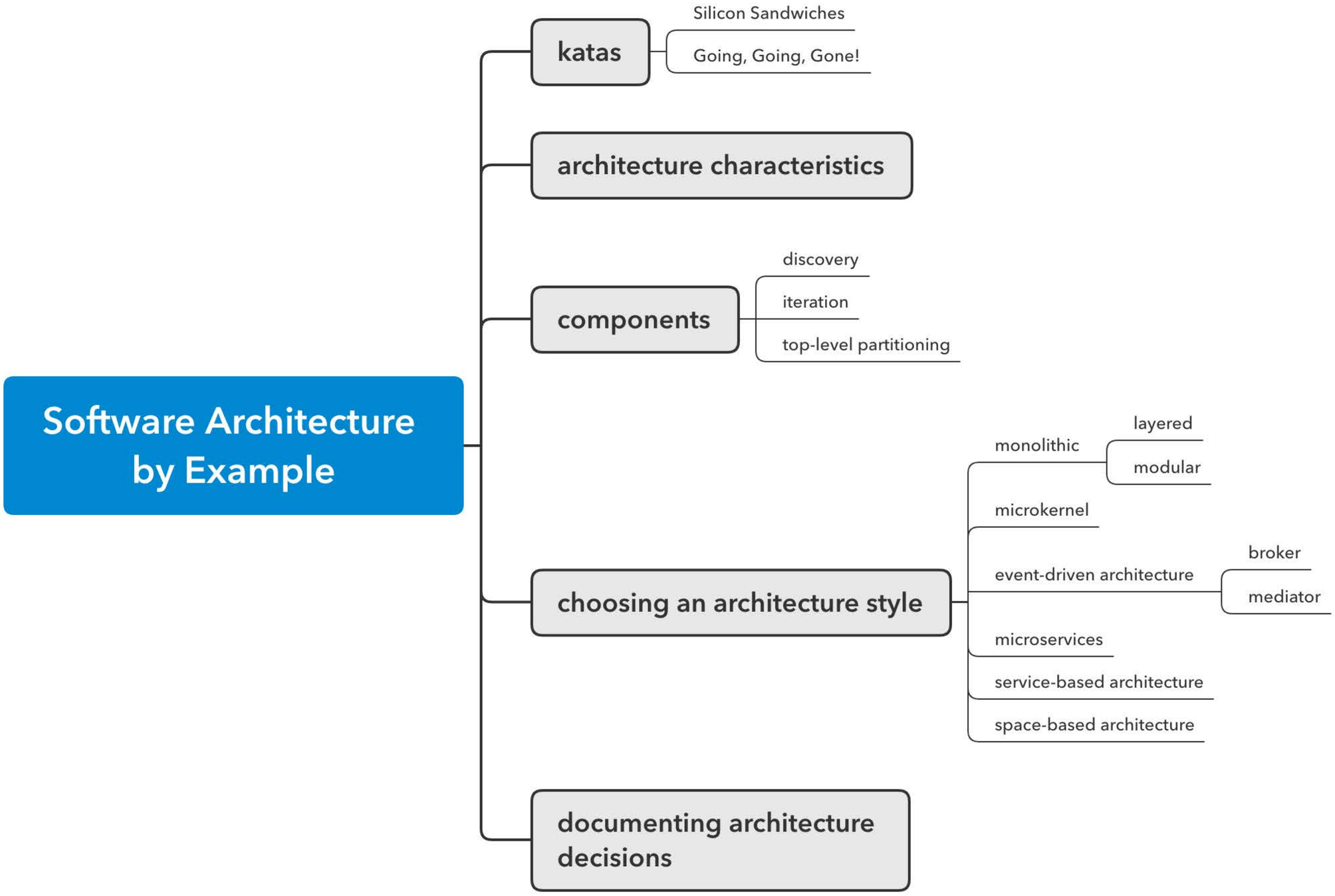
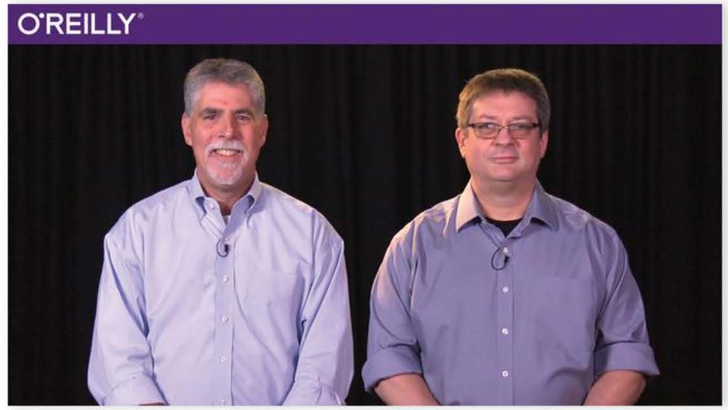

Software Architecture by Example
katas
Silicon Sandwiches
Going, Going, Gone!
architecture characteristics
components
discovery
iteration
top-level partitioning
choosing an architecture style
monolithic
layered
modular
microkernel
event-driven architecture
broker
mediator
microservices
service-based architecture
space-based architecture
documenting architecture decisions

course references



Software Architecture Fundamentals, Second Edition

★★★★★ 9 reviews

by Mark Richards, Neal Ford

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Release Date: November 2017

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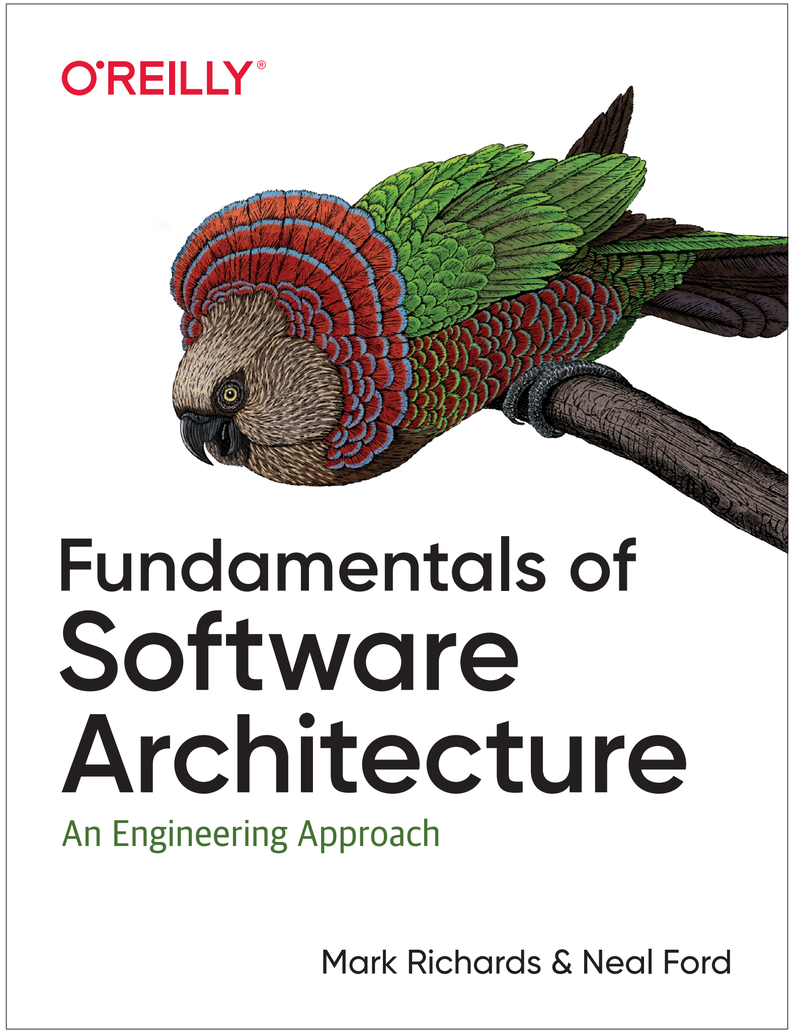
https://learning.oreilly.com/library/view/software-architecture-fundamentals/9781491998991/

course references



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Your Architectural Kata is...

Silicon Sandwiches

A national sandwich shop wants to enable internet-ordering (in addition to their current call-in service)

- ***Users:*** thousands, perhaps one day millions
- ***Requirements:***
  - users will place their order, then be given a time to pick up their sandwich and directions to the shop (which must integrate with several external mapping services that include traffic information)
  - if the shop offers a delivery service, dispatch the driver with the sandwich to the user
  - mobile-device accessibility
  - offer national daily promotions/specials
  - offer local daily promotions/specials
  - accept payment online or in person/on delivery
- ***Additional Context:***
  - Sandwich shops are franchised, each with a different owner.
  - Parent company has near-future plans to expand overseas.
  - Corporate goal is to hire inexpensive labor to maximize profit.
  - Time to market is critical.

First Law of Software Architecture:

Everything in software architecture is a tradeoff.

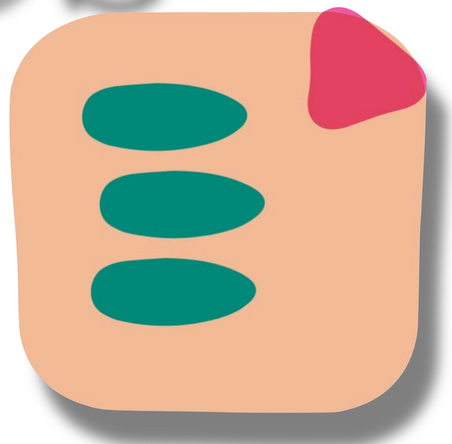
First Law of Software Architecture:

Everything in software architecture is a tradeoff.

First Corollary:

If you think you've found something that *isn't* a tradeoff, it just means you haven't identified the tradeoff…yet.

architecture characteristics



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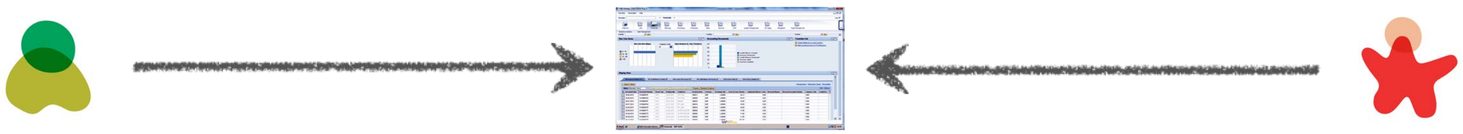

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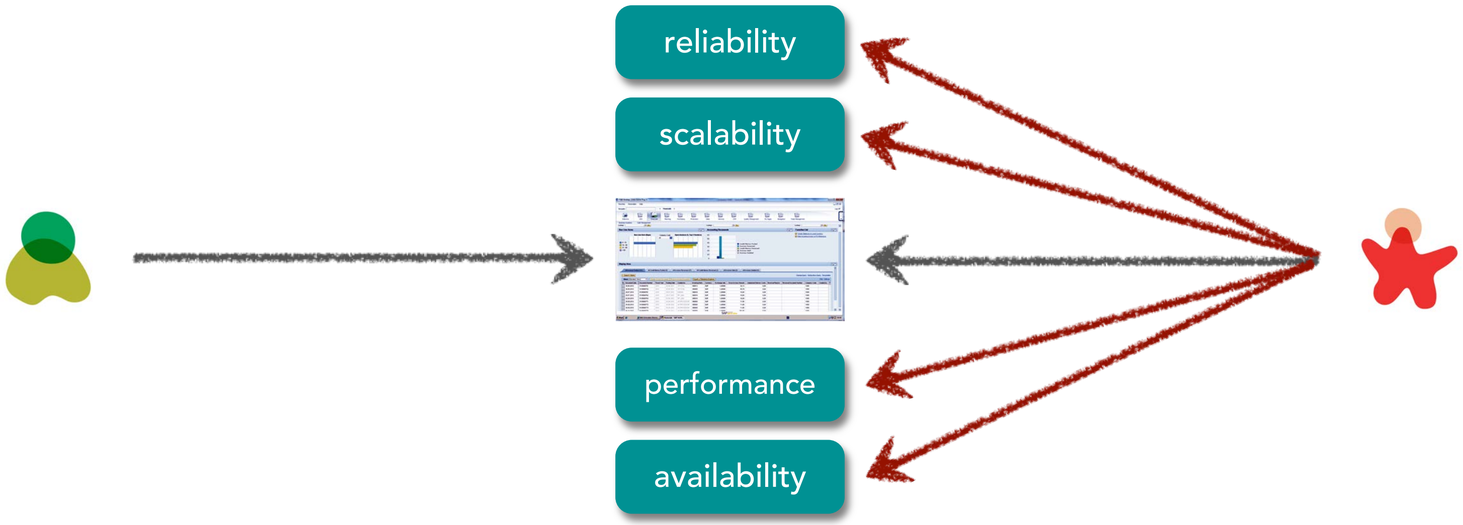

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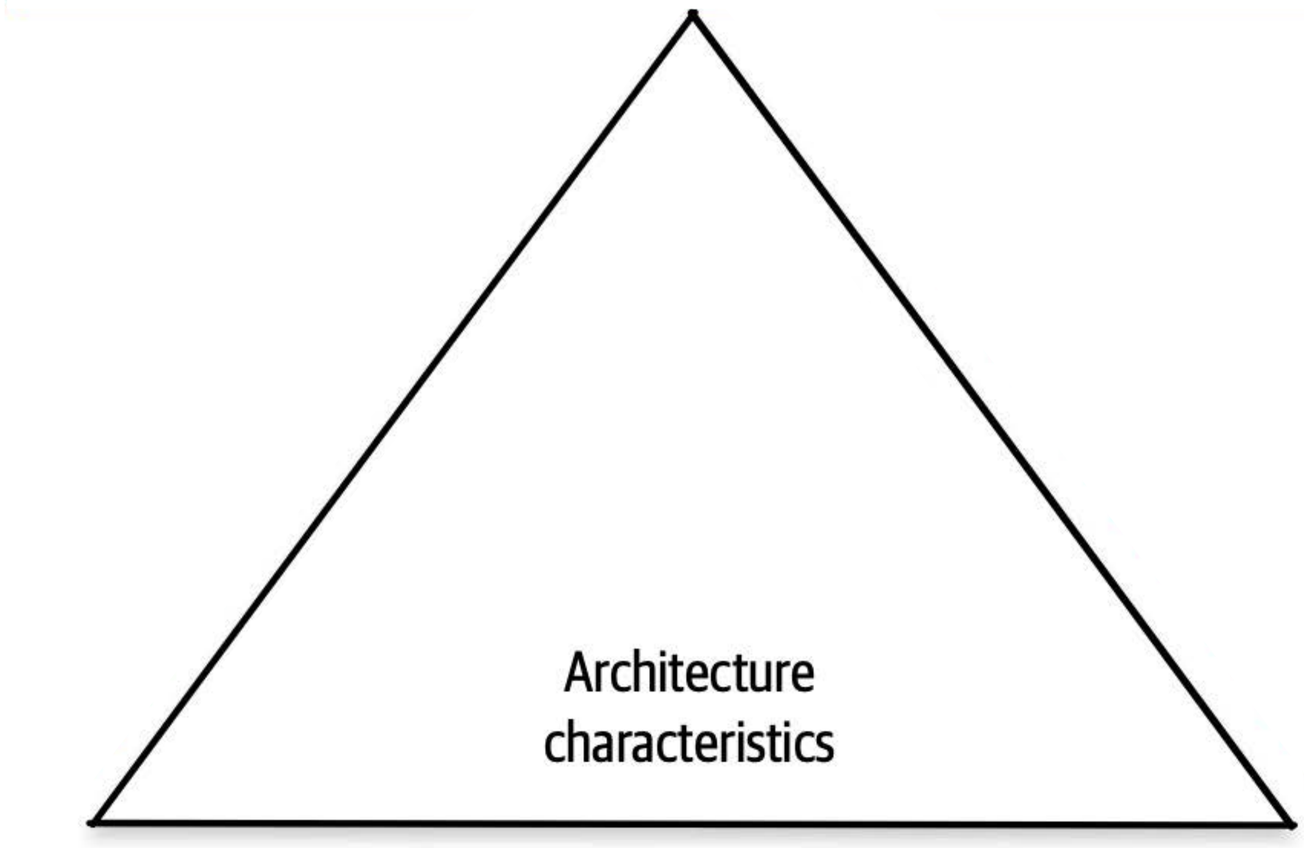

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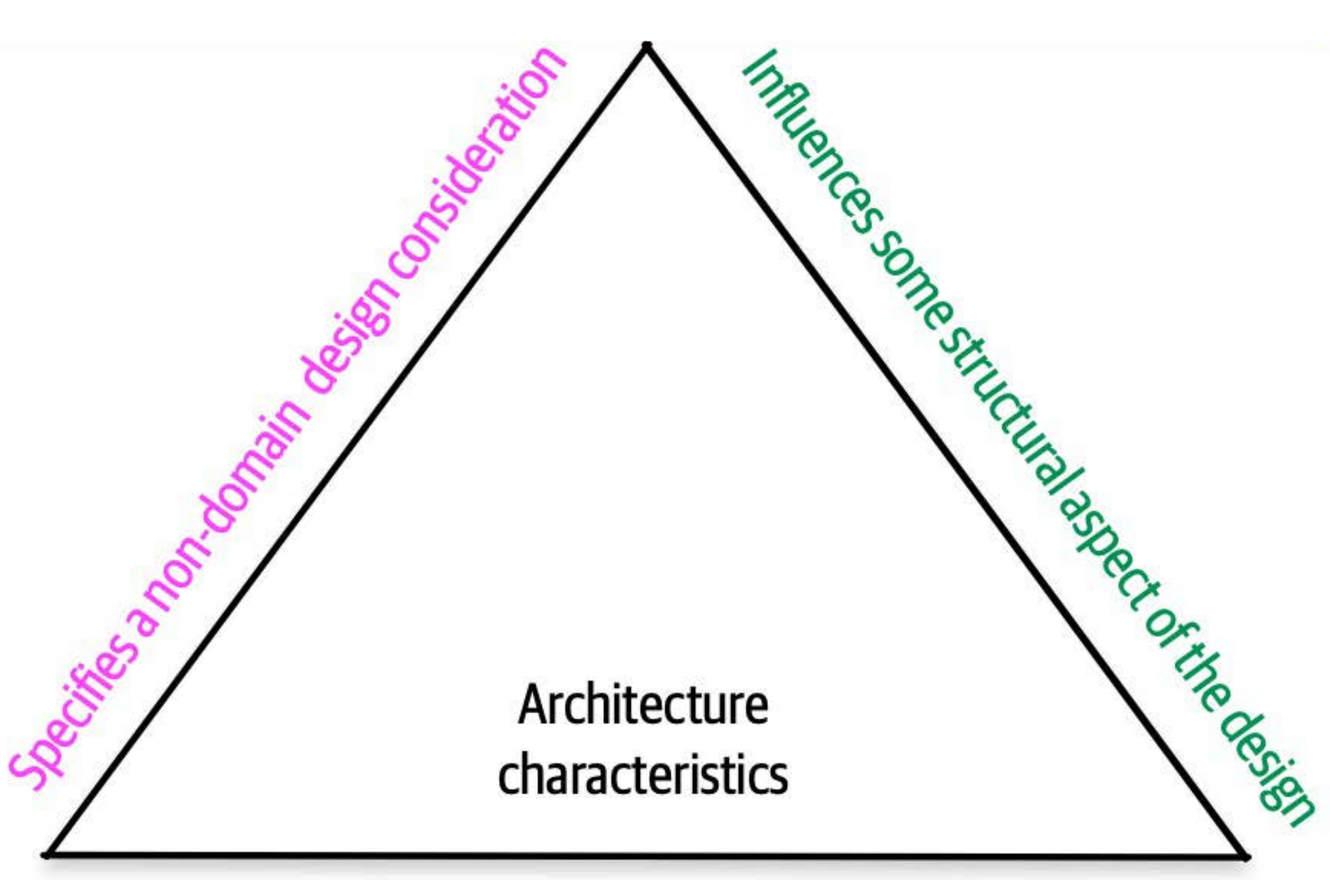
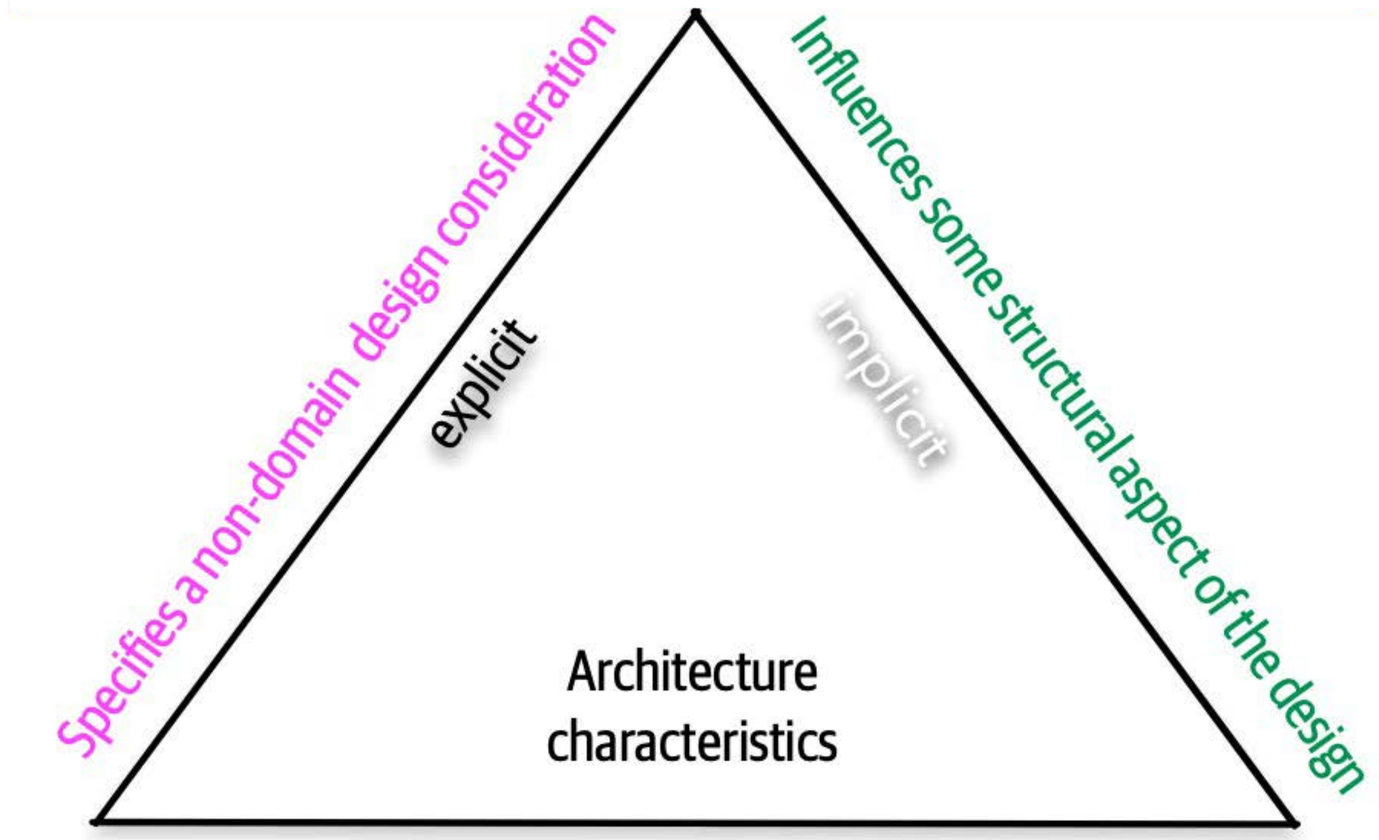


Critical or important to application success

One pathway to simpler design.

architecture characteristics



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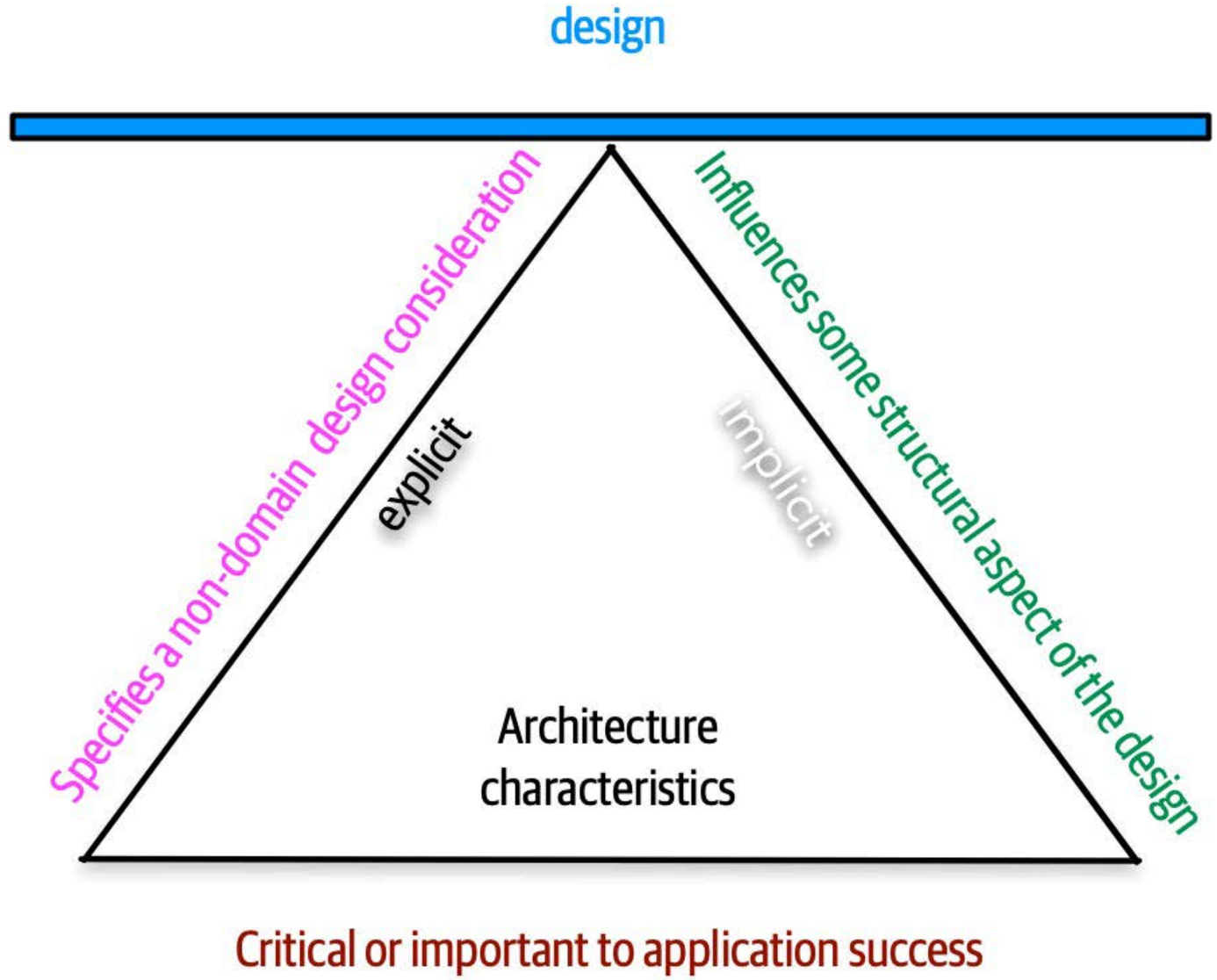
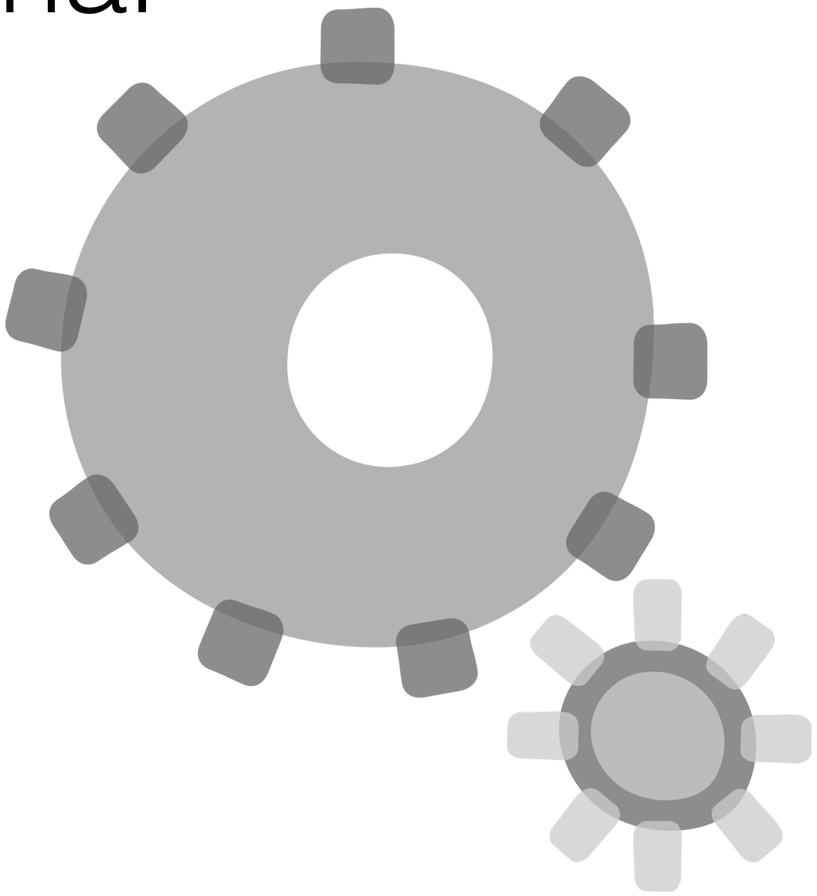


architecture characteristics

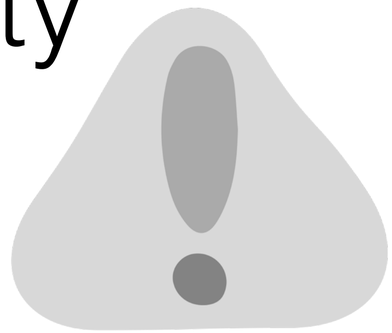
operational



Performance
Scalability
Elasticity
Reliability

architecture characteristics

quality



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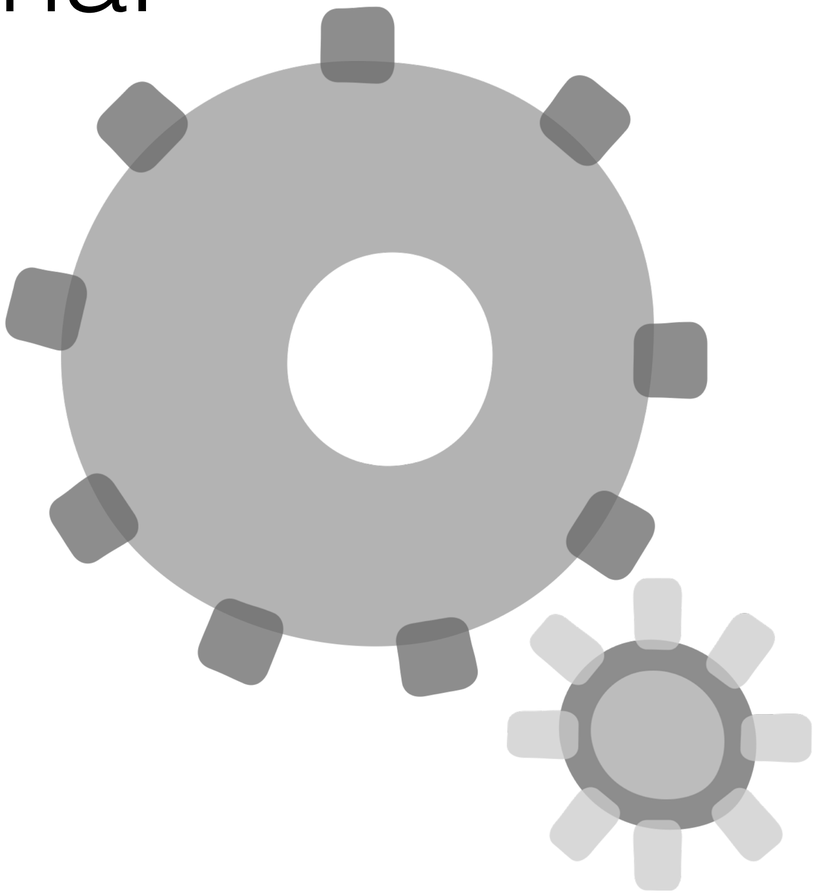

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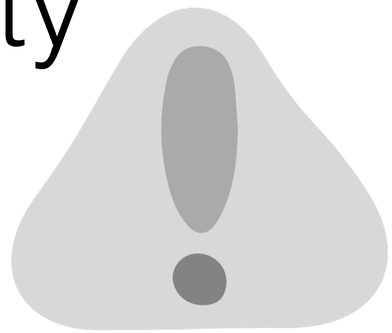

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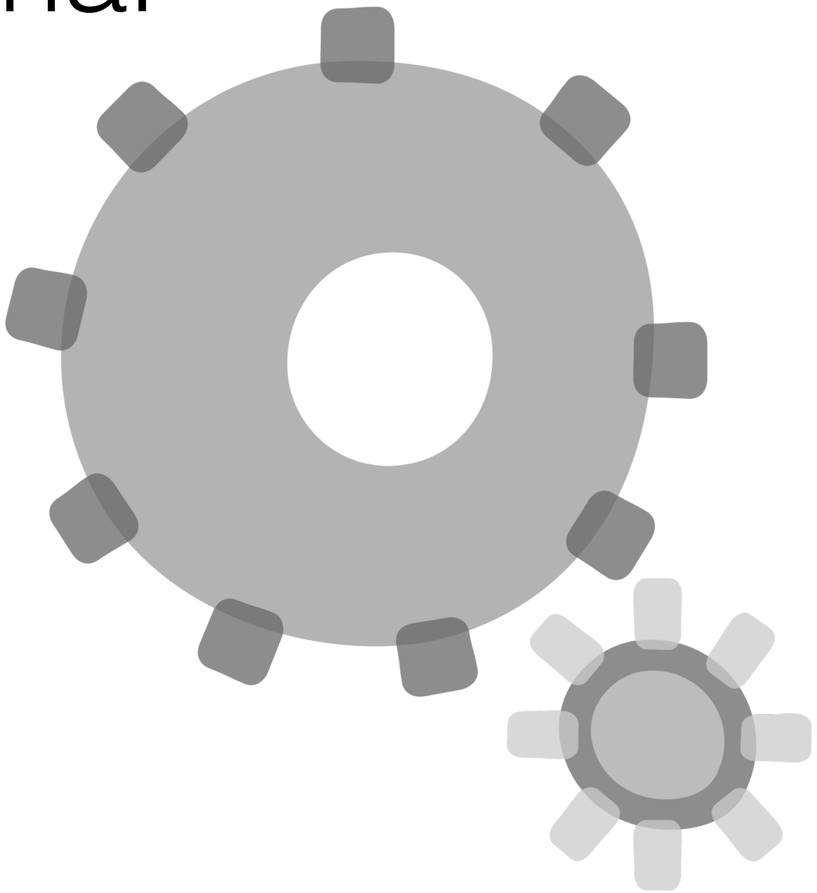
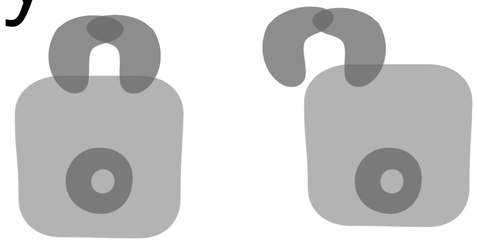
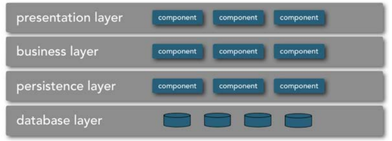


security

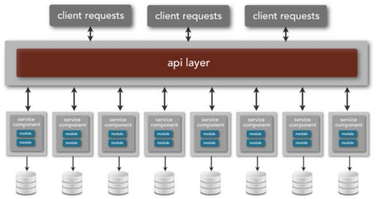


architecture characteristics

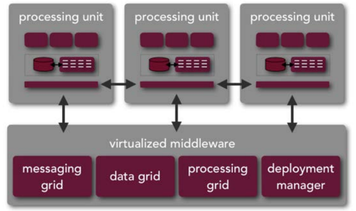
feasibility



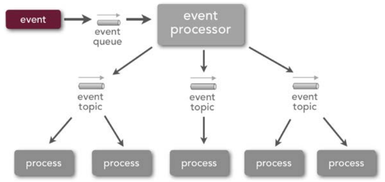
agility

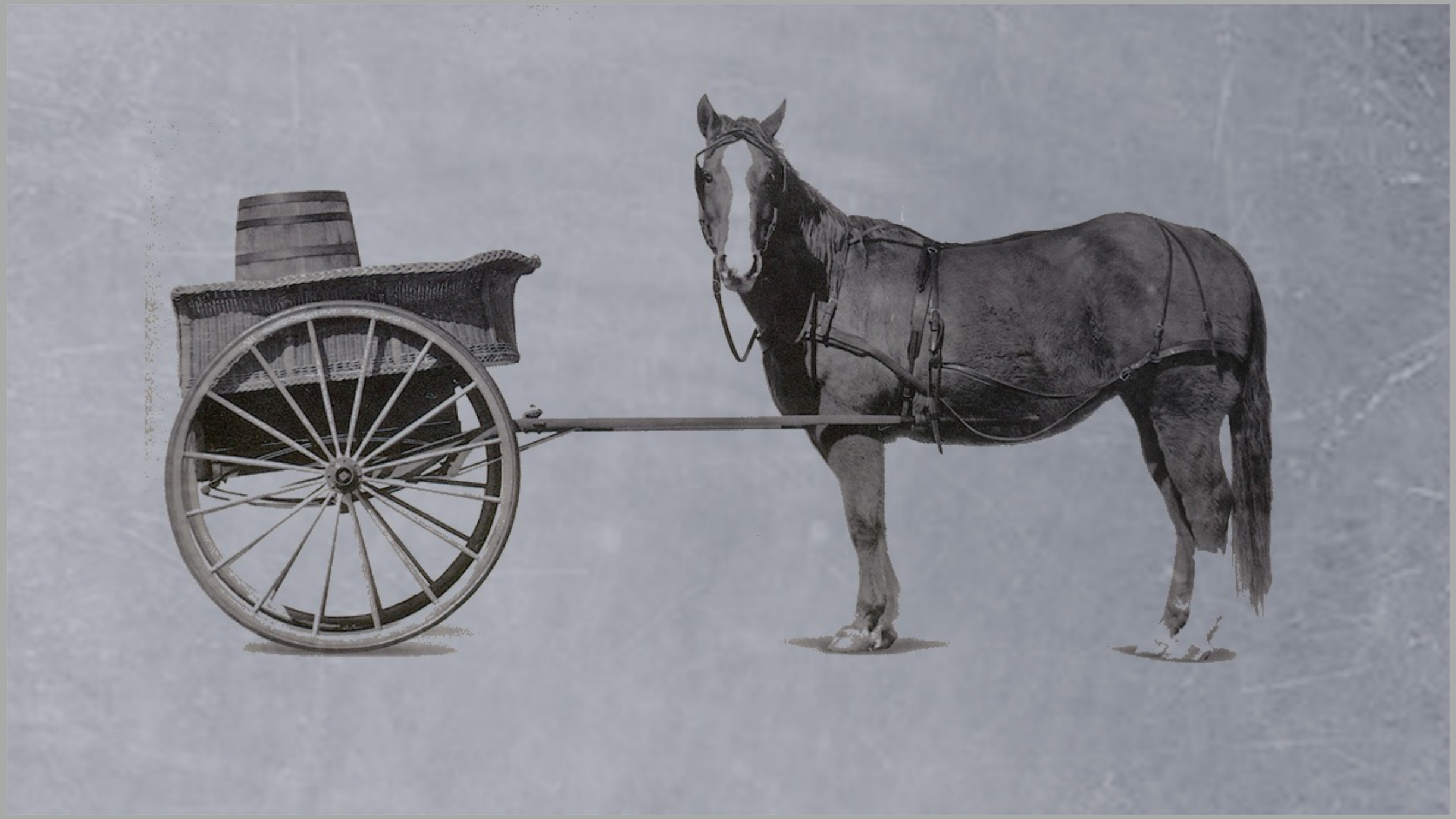


elasticity



scalability





architecture katas

identifying driving characteristics

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Going Going Gone!

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- **Users**: scale up to hundreds of participants (per auction), potentially up to thousands of participants, and as many simultaneous auctions as possible
- **Requirements**:
  - bidders can see a live video stream of the auction and see all bids as they occur
  - auctions must be as real-time as possible
  - both online and live bids must be received in the order in which they are placed
  - video stream of the action after the fact
  - bidders register with credit card; system automatically charges card if bidder wins
  - participants must be tracked via a reputation index
- **Additional Context:**
  - auction company is expanding aggressively by merging with smaller competitors
  - if nationwide auction is a success, replicate the model overseas
  - budget is not constrained--this is a strategic direction
  - company just exited a lawsuit where they settled a suit alleging fraud

Your Architectural Kata is...

Silicon Sandwiches

A national sandwich shop wants to enable 'fax in your order' but over the Internet instead (in addition to their current fax-in service)

- ***Users:*** thousands, perhaps one day millions
- ***Requirements:***
  - users will place their order, then be given a time to pick up their sandwich and directions to the shop (which must integrate with several external mapping services that include traffic information)
  - if the shop offers a delivery service, dispatch the driver with the sandwich to the user
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availability reliability performance

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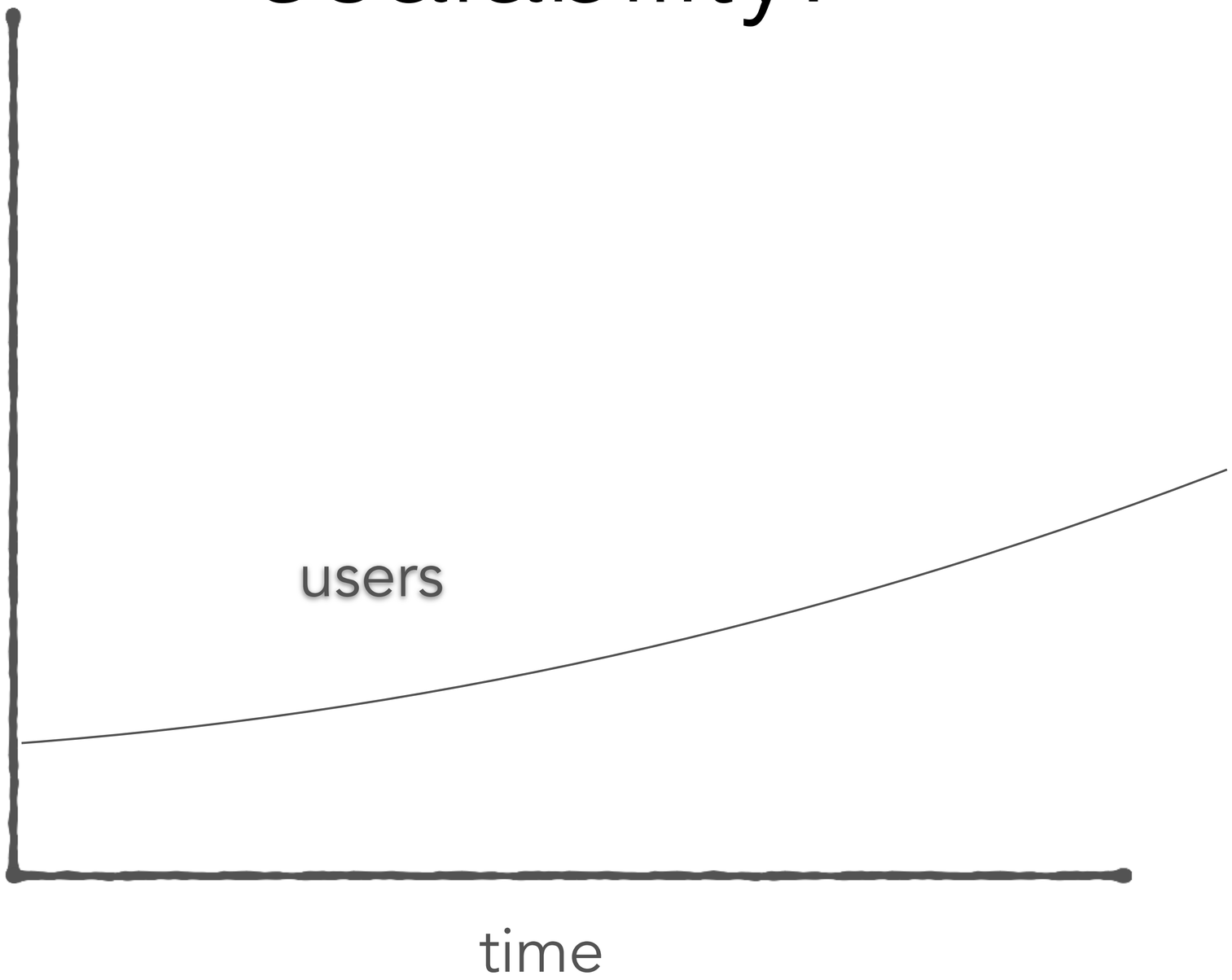
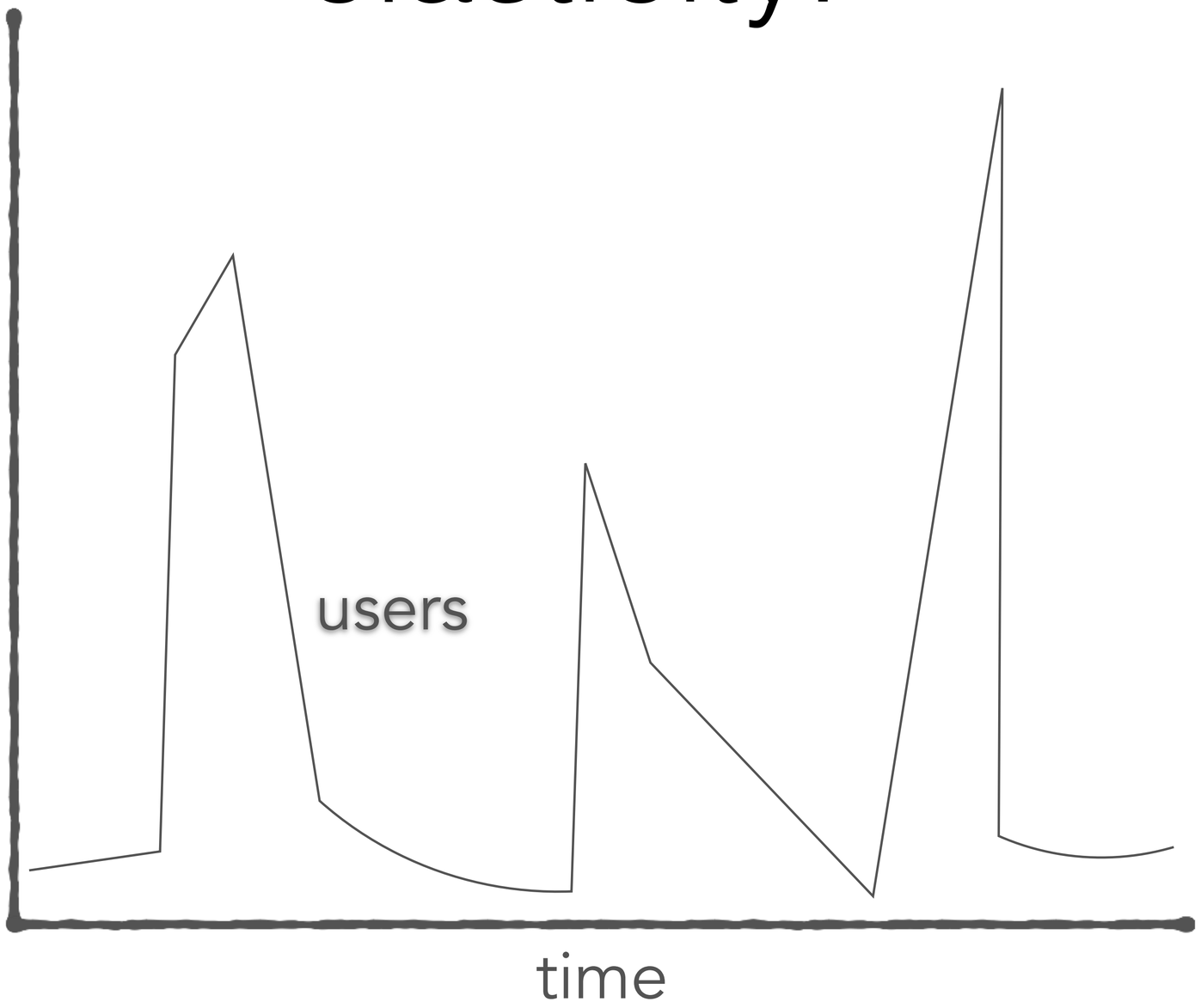
availability reliability performance scalability elasticity

scalability:



elasticity:



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availability reliability performance scalability elasticity (security)

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concurrency

availability reliability performance scalability elasticity (security)

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  - company just exited a lawsuit where they settled a suit alleging fraud

availability reliability performance scalability elasticity concurrency (security)

Your Architectural Kata is...

Silicon Sandwiches

A national sandwich shop wants to enable 'fax in your order' but over the Internet instead (in addition to their current fax-in service)

- ***Users:*** thousands, perhaps one day millions
- ***Requirements:***
  - users will place their order, then be given a time to pick up their sandwich and directions to the shop (which must integrate with several external mapping services that include traffic information)
  - if the shop offers a delivery service, dispatch the driver with the sandwich to the user
  - mobile-device accessibility
  - offer national daily promotions/specials
  - offer local daily promotions/specials
  - accept payment online or in person/on delivery
- ***Additional Context:***
  - Sandwich shops are franchised, each with a different owner.
  - Parent company has near-future plans to expand overseas.
  - Corporate goal is to hire inexpensive labor to maximize profit.
  - Time to market is critical.

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performance availability reliability

scalability elasticity i18n l10n

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Global Customizability Local Customizability

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performance availability reliability

scalability elasticity

Customizability { location, sales, recipe

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architecture katas

identifying major components

Your Architectural Kata is...

Going Going Gone!

An auction company wants to take their auctions online to a nationwide scale--customers choose the auction to participate in, wait until the auction begins, then bid during the live auction as if they were there in the room, with the auctioneer.

- **Users**: scale up to hundreds of participants (per auction), potentially up to thousands of participants, and as many simultaneous auctions as possible
- **Requirements**:
  - bidders can see a live video stream of the auction and see all bids as they occur
  - auctions must be as real-time as possible
  - both online and live bids must be received in the order in which they are placed
  - video stream of the action after the fact
  - bidders register with credit card; system automatically charges card if bidder wins
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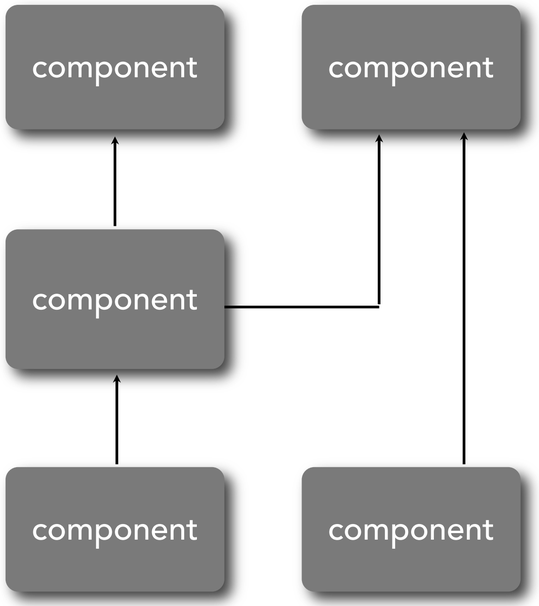
component identification

as an architect, you should think about the artifacts within the architecture in terms of *components*



component:

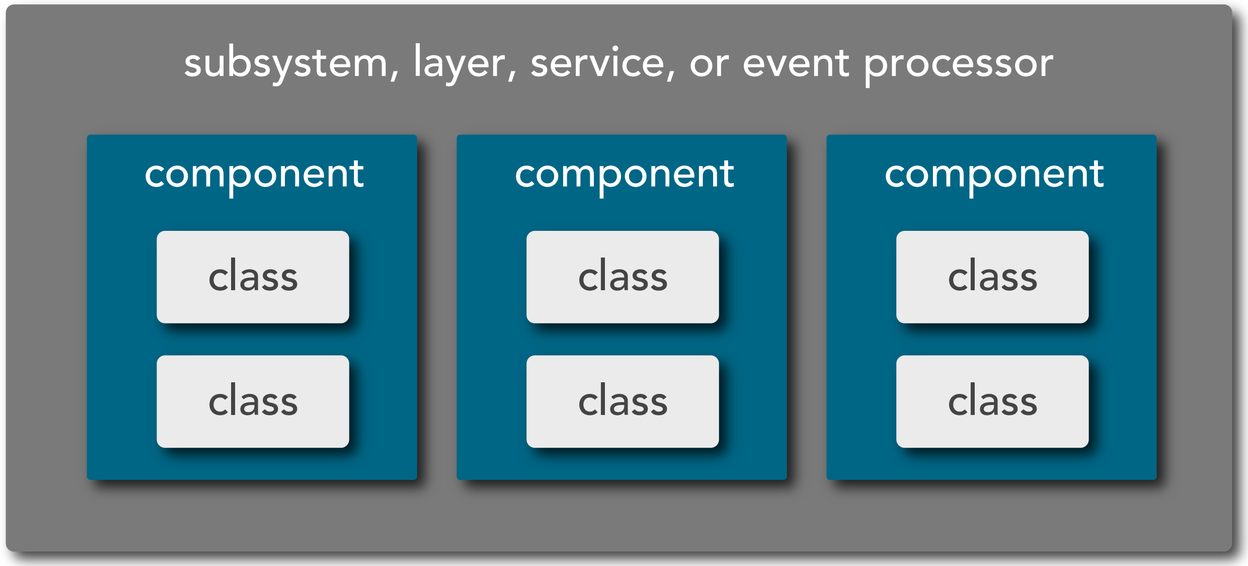
building block of the application

well defined set of operations

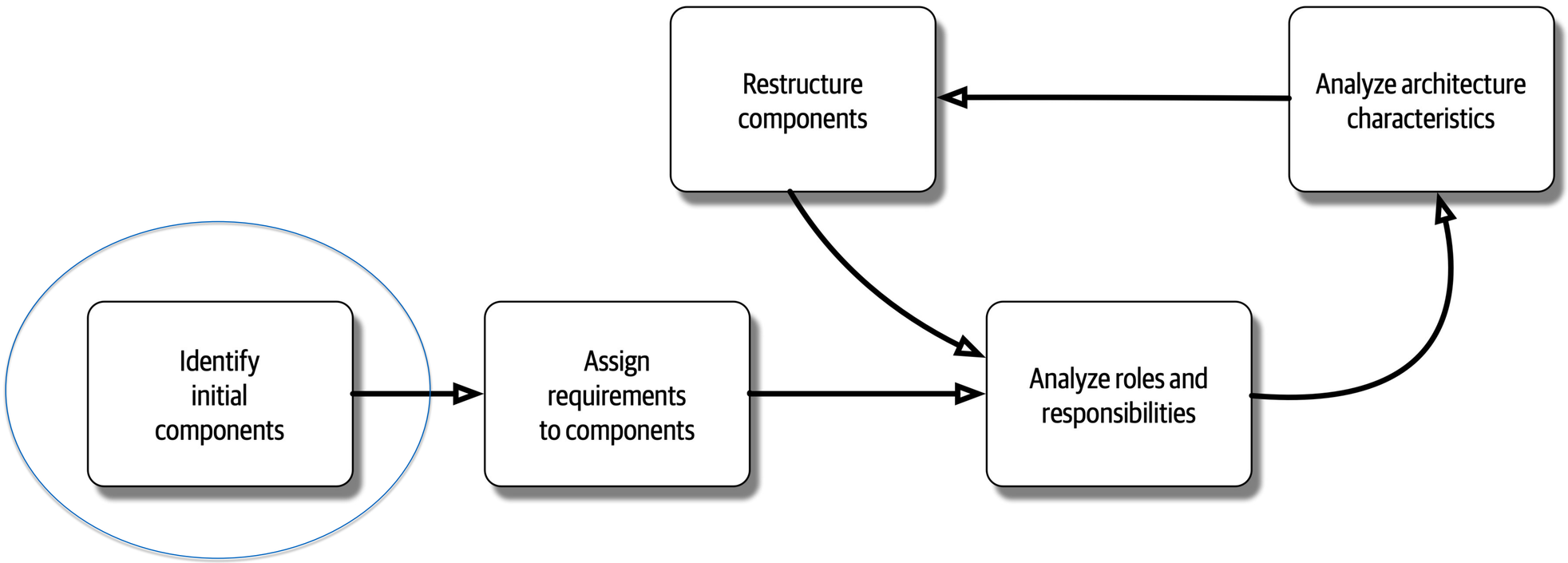
well defined role and responsibility

component identification

component scope

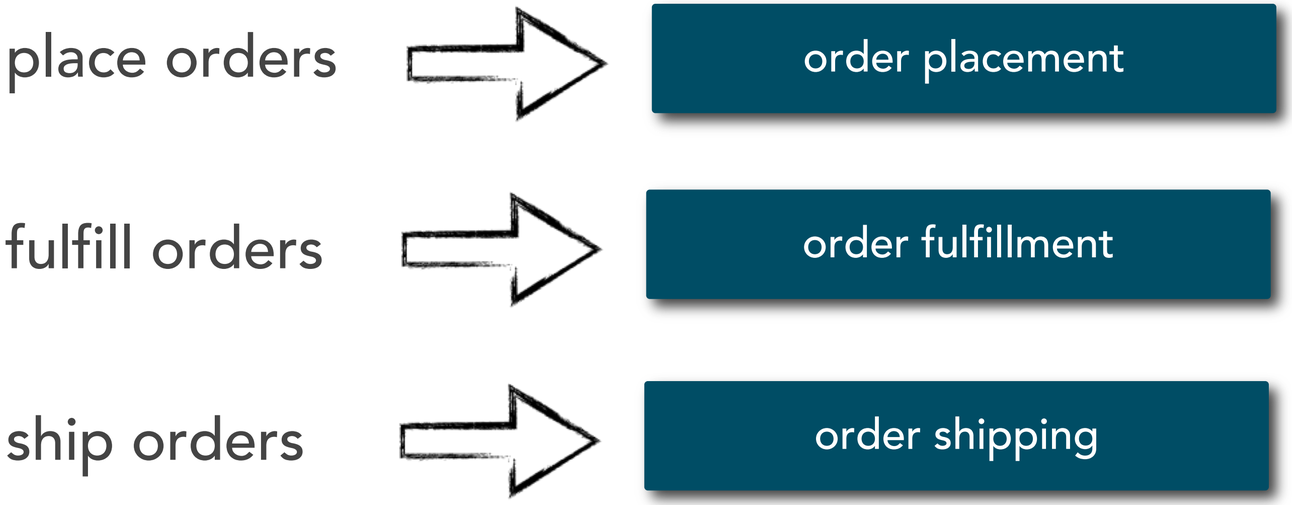


component identification



component identification

identify initial components using core functionality



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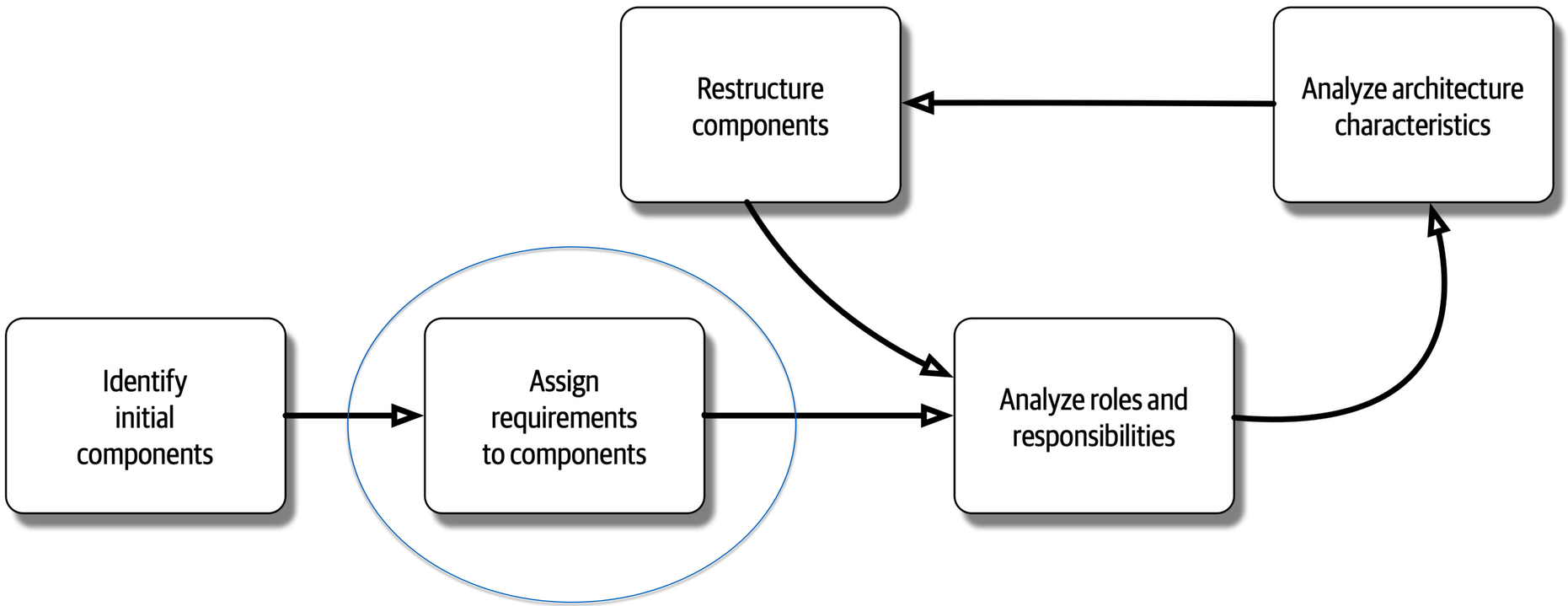
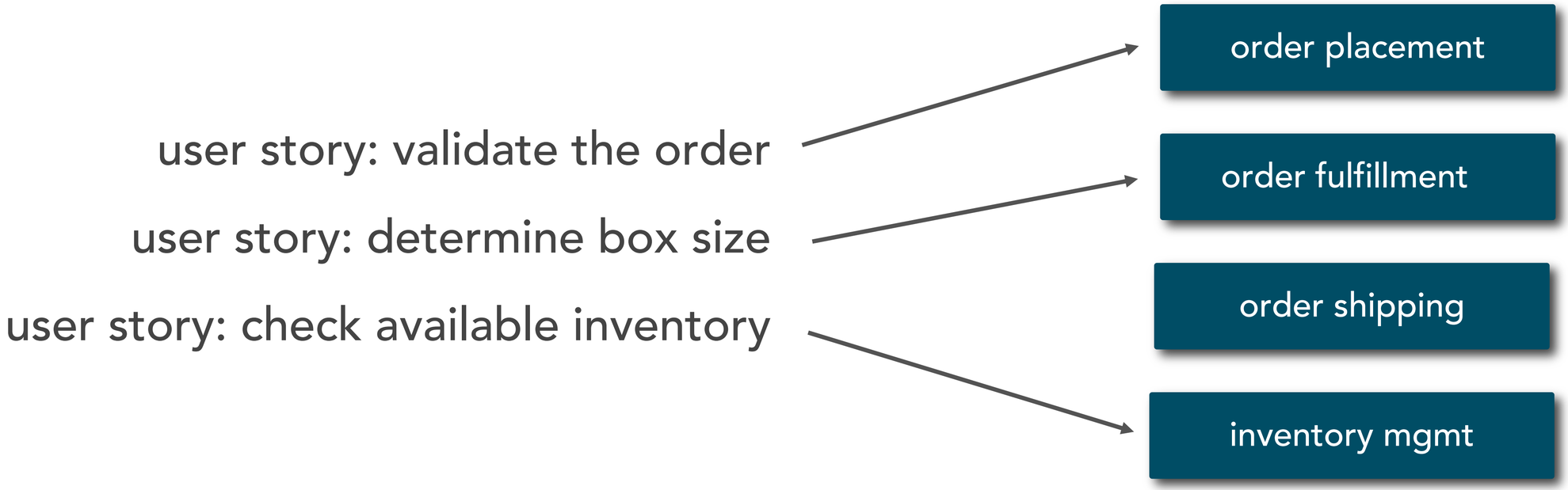


component identification

assign requirements, use cases, or user stories to a component



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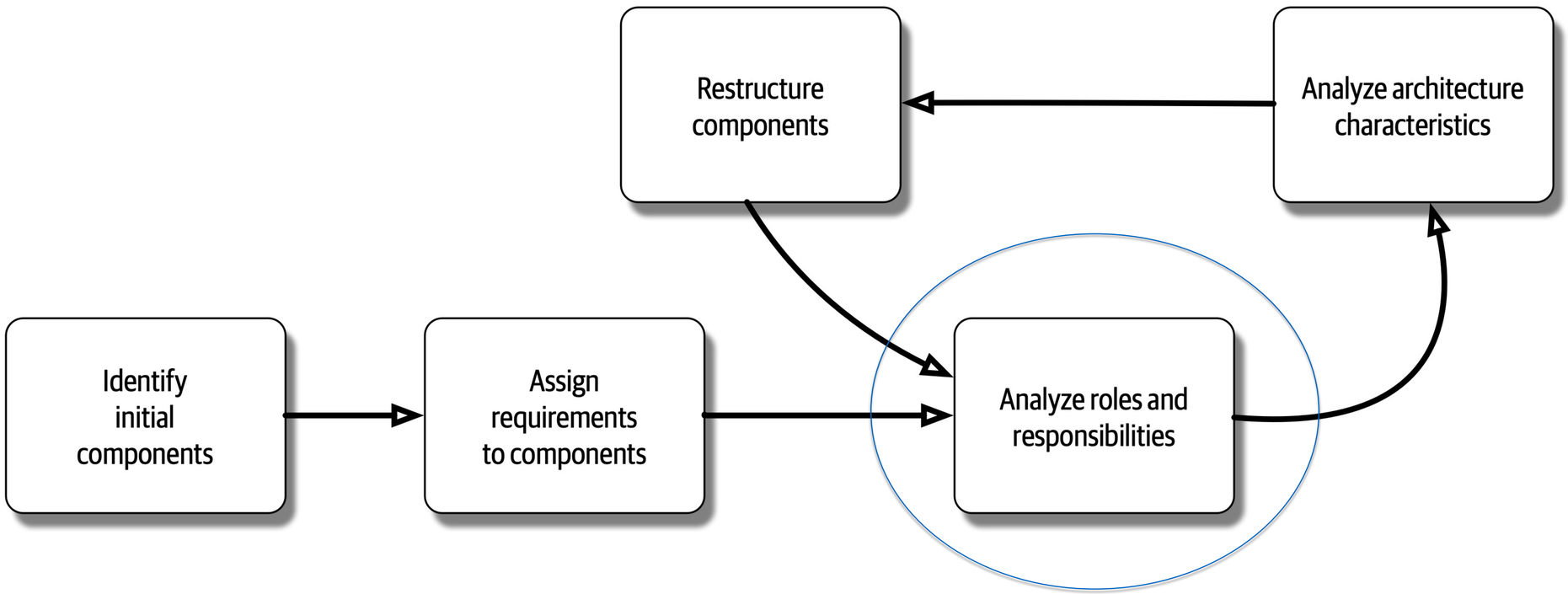


component identification

component granularity

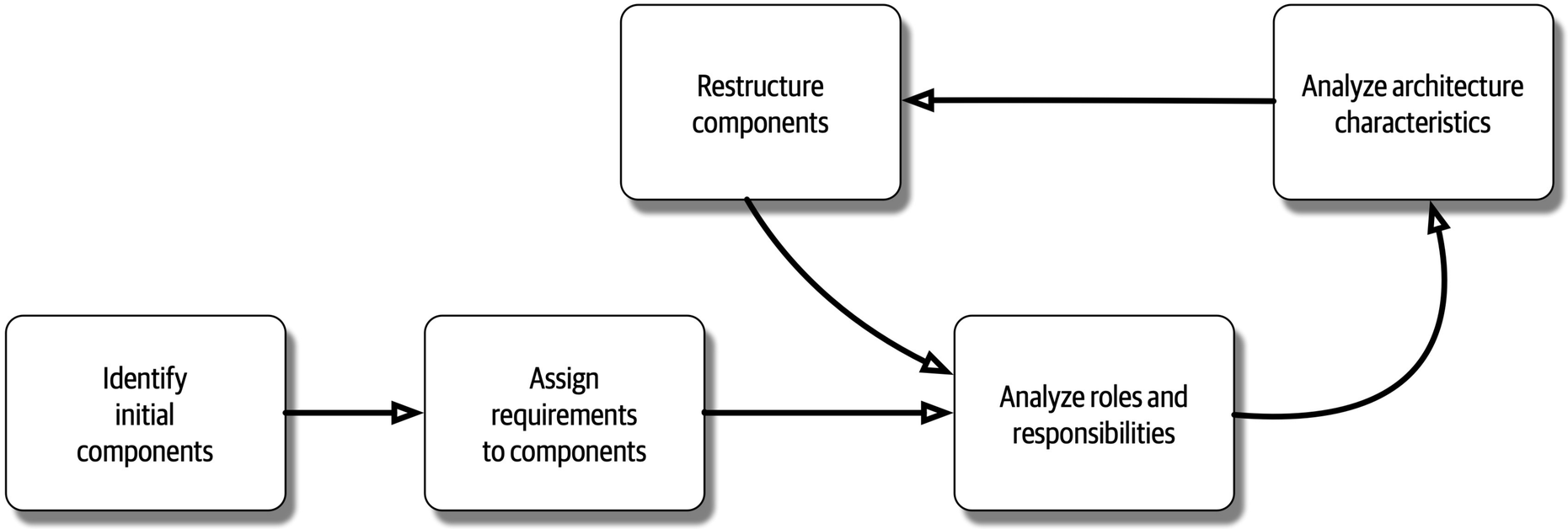
responsible for creating, deleting, and updating orders. also responsible for shipping the order and tracking the order once it has been shipped. this component is also responsible for notifying the customer each time the order status changes.

component identification

component granularity

order maintenance	responsible for creating, deleting, and updating orders.
order shipment	responsible for shipping and tracking orders
customer notification	responsible for notifying the customer when the order status changes.

component identification



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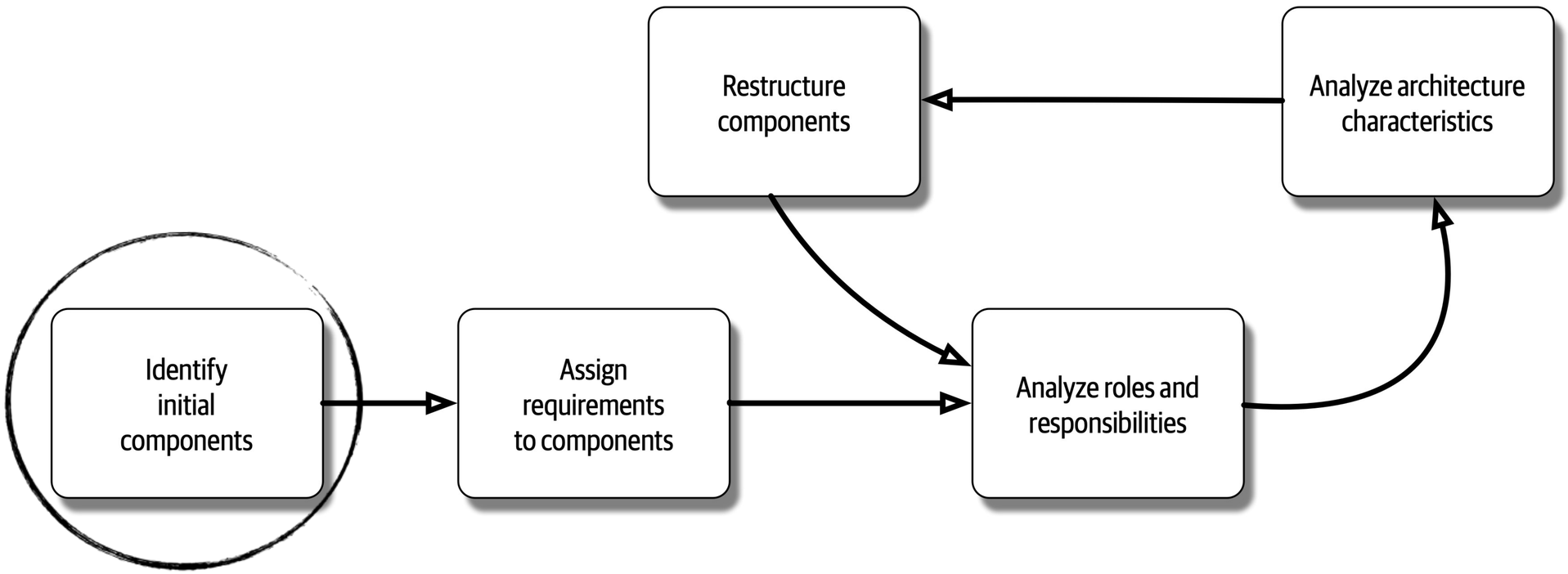


Your Architectural Kata is...

Going Going Gone!

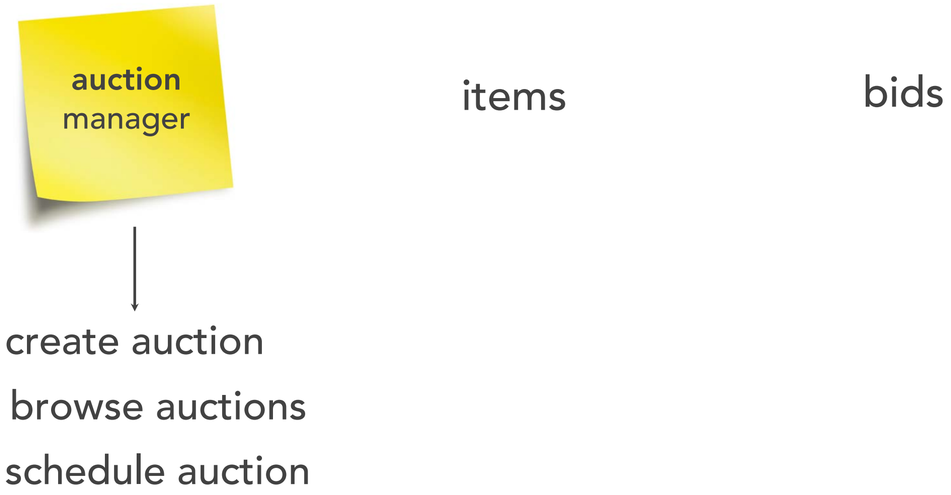
the “entity trap”

auctions items bids

Your Architectural Kata is...

Going Going Gone!

the “entity trap”



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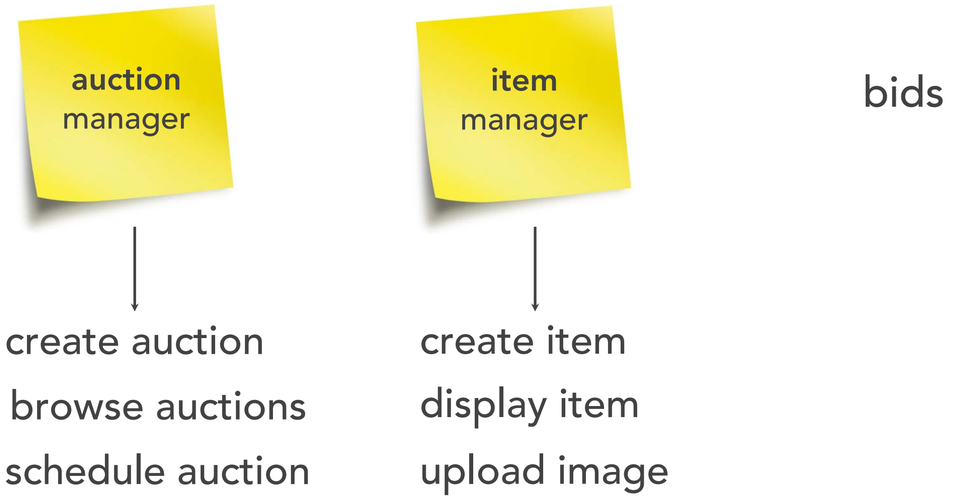

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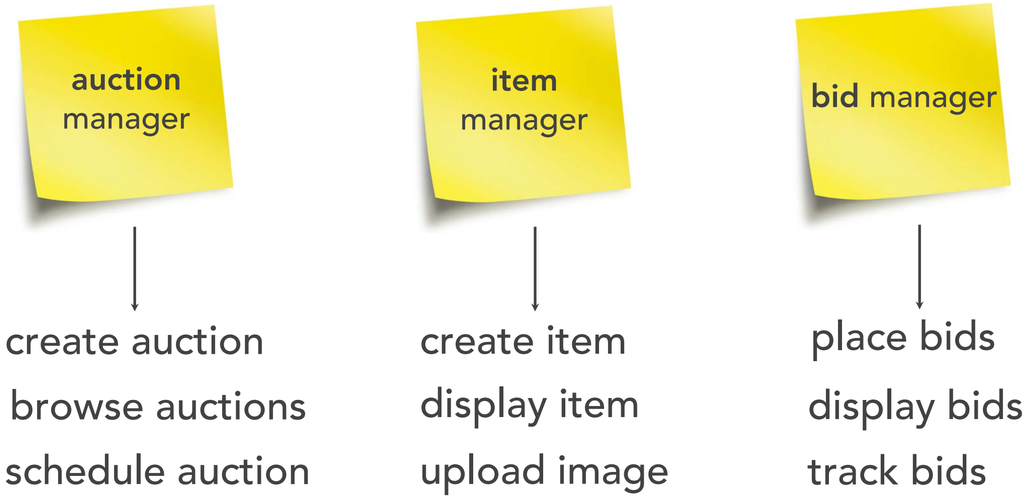

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Going Going Gone!

workflow approach

create auction ⟶ find auction ⟶ sign up ⟶ watch auction ⟶ place bid

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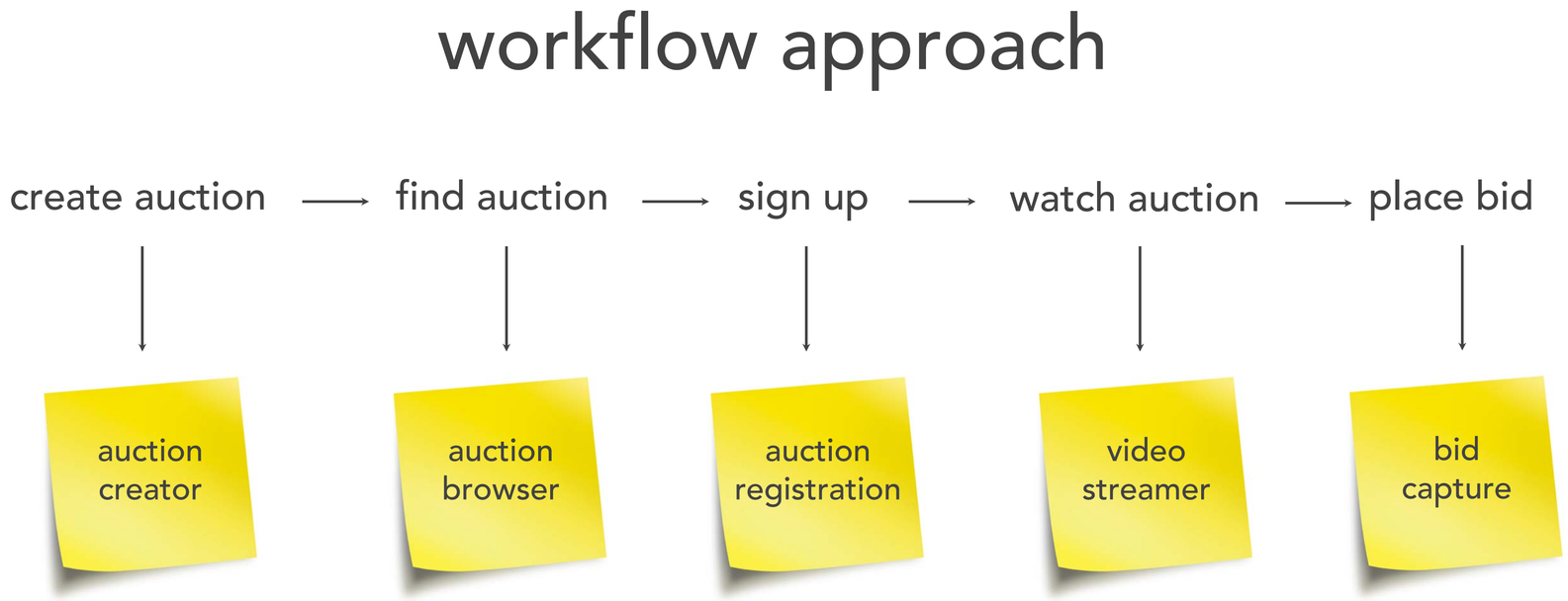

Your Architectural Kata is...

Going Going Gone!

actor/action approach

bidder

auctioneer

system

Your Architectural Kata is...

Going Going Gone!

actor/action approach

bidder

auctioneer

system

view live video stream

view live bid stream

place a bid

Your Architectural Kata is...

Going Going Gone!

actor/action approach

bidder

auctioneer

system

view live video stream
view live bid stream
place a bid

enter live bids into system
receive online bid
mark item as sold

Your Architectural Kata is...

Going Going Gone!

actor/action approach

bidder

view live video stream
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enter live bids into system
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mark item as sold

system

start auction
make payment
track bidder activity

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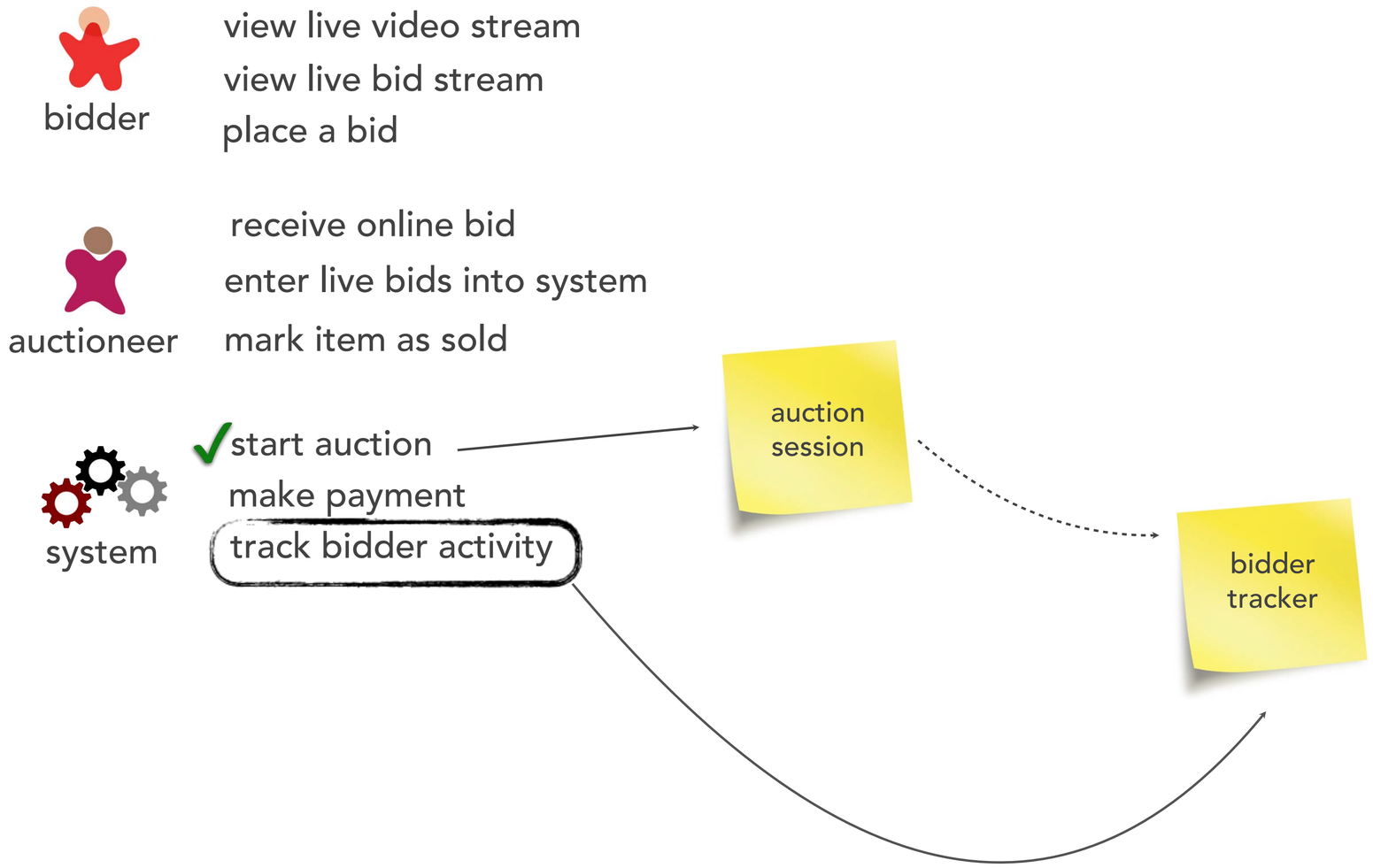

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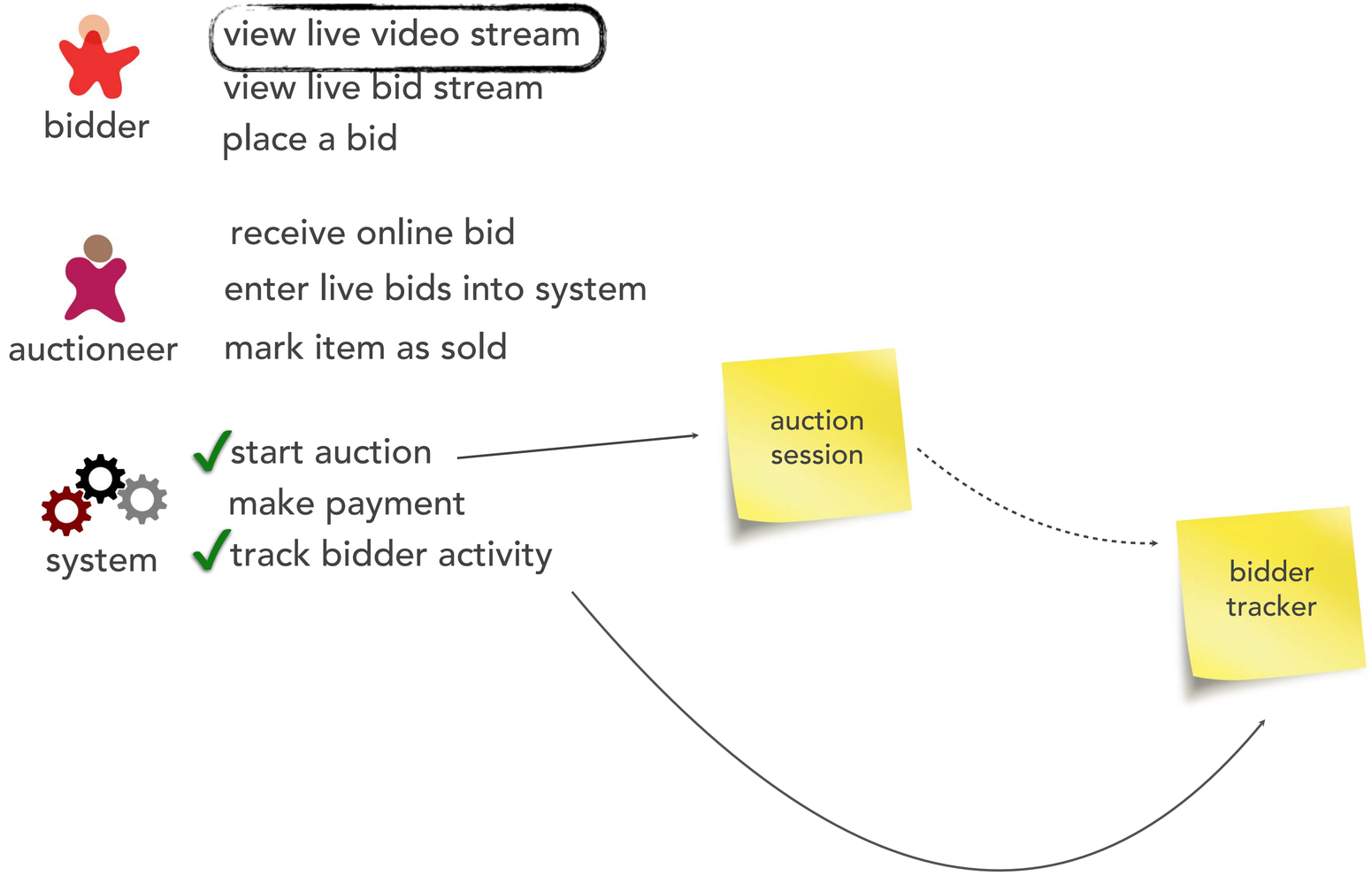

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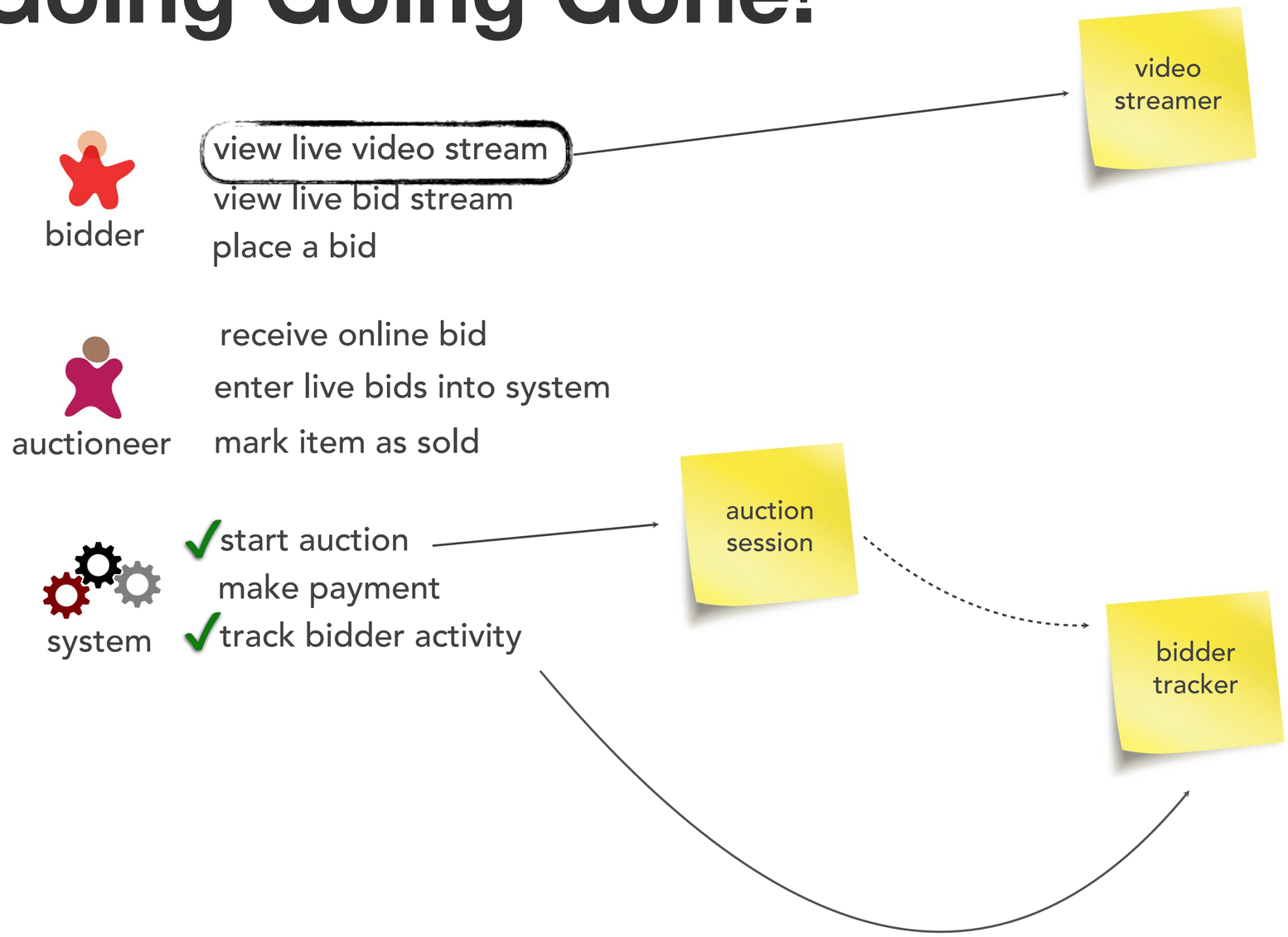

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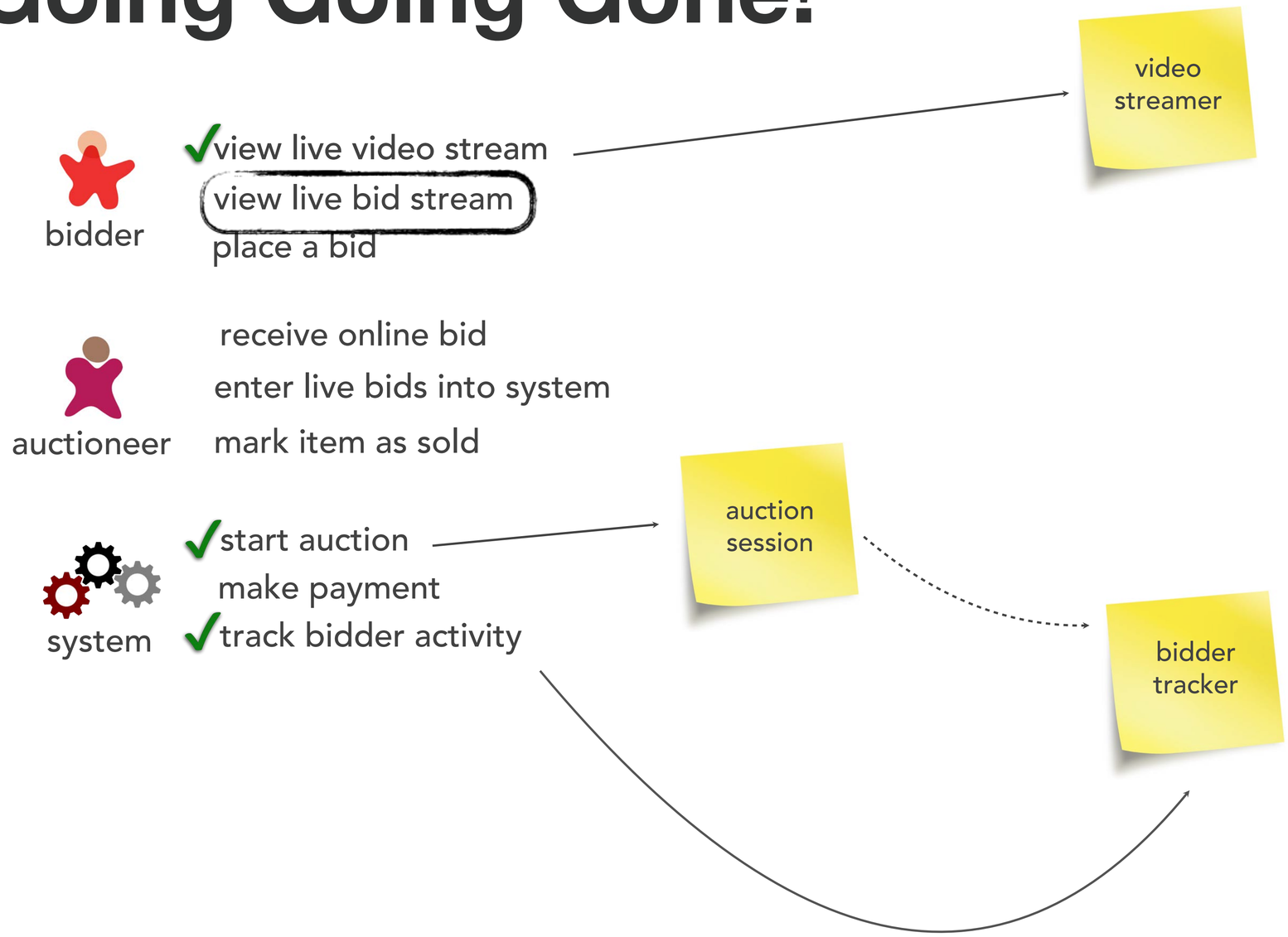

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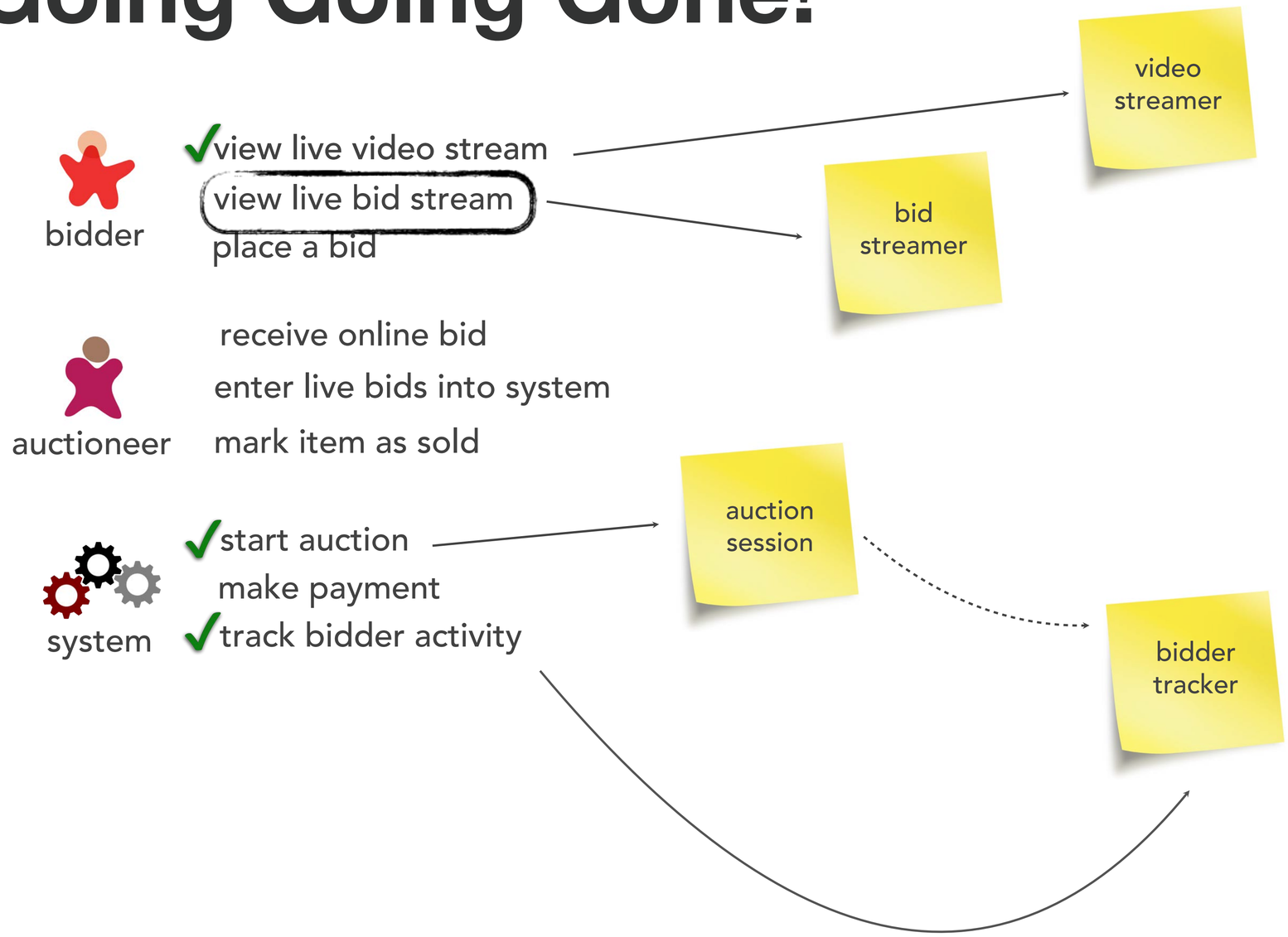

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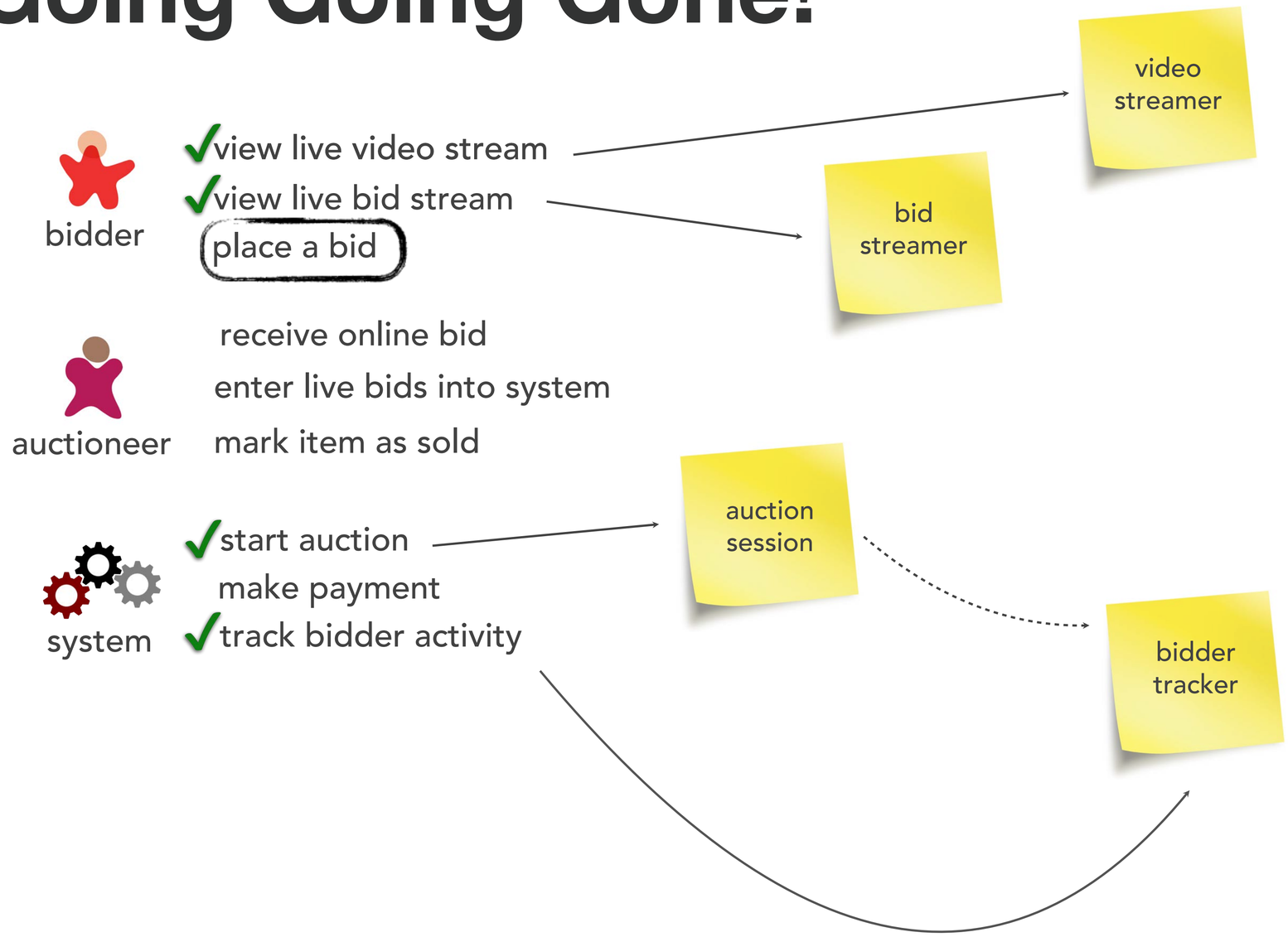

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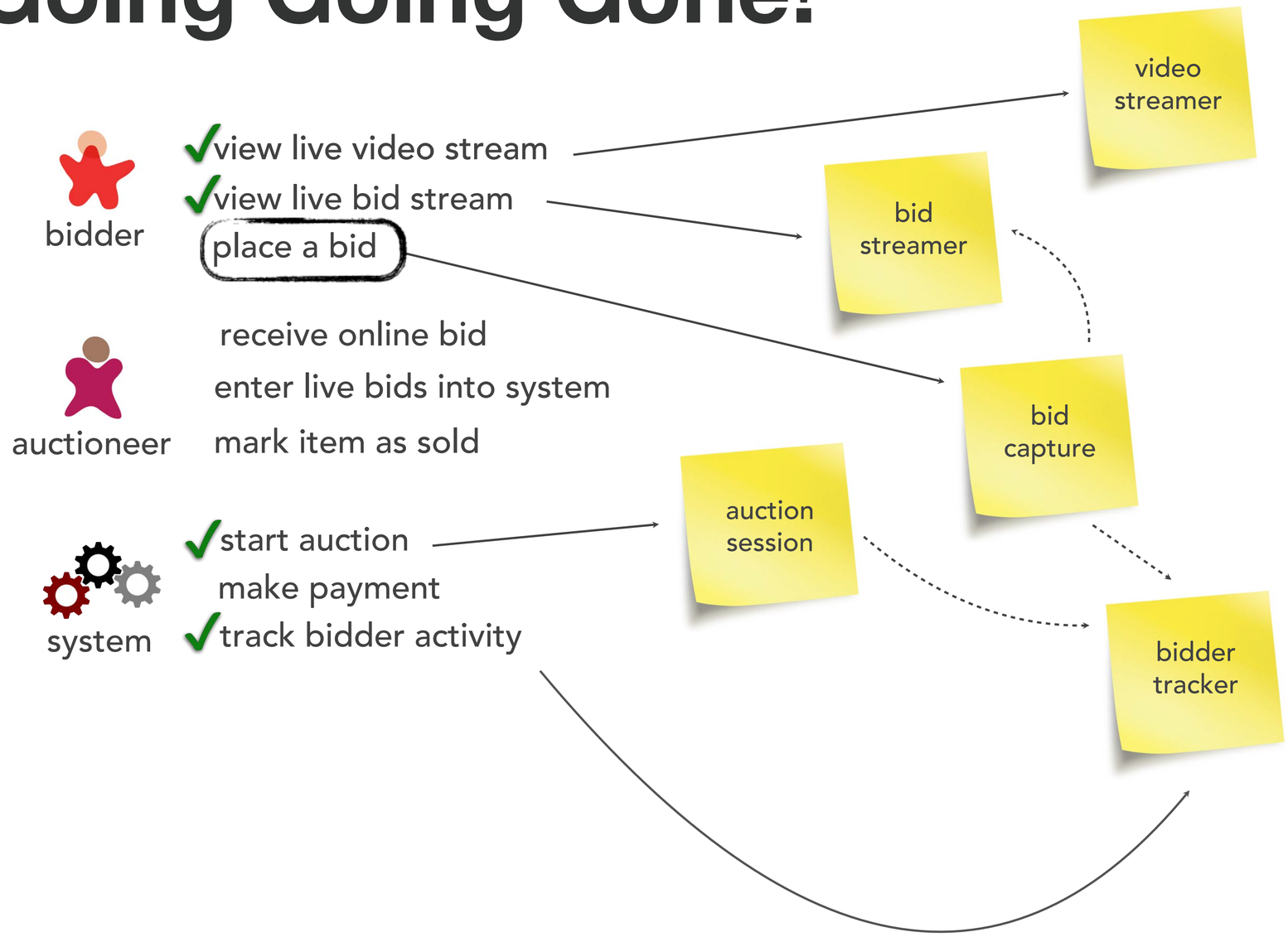

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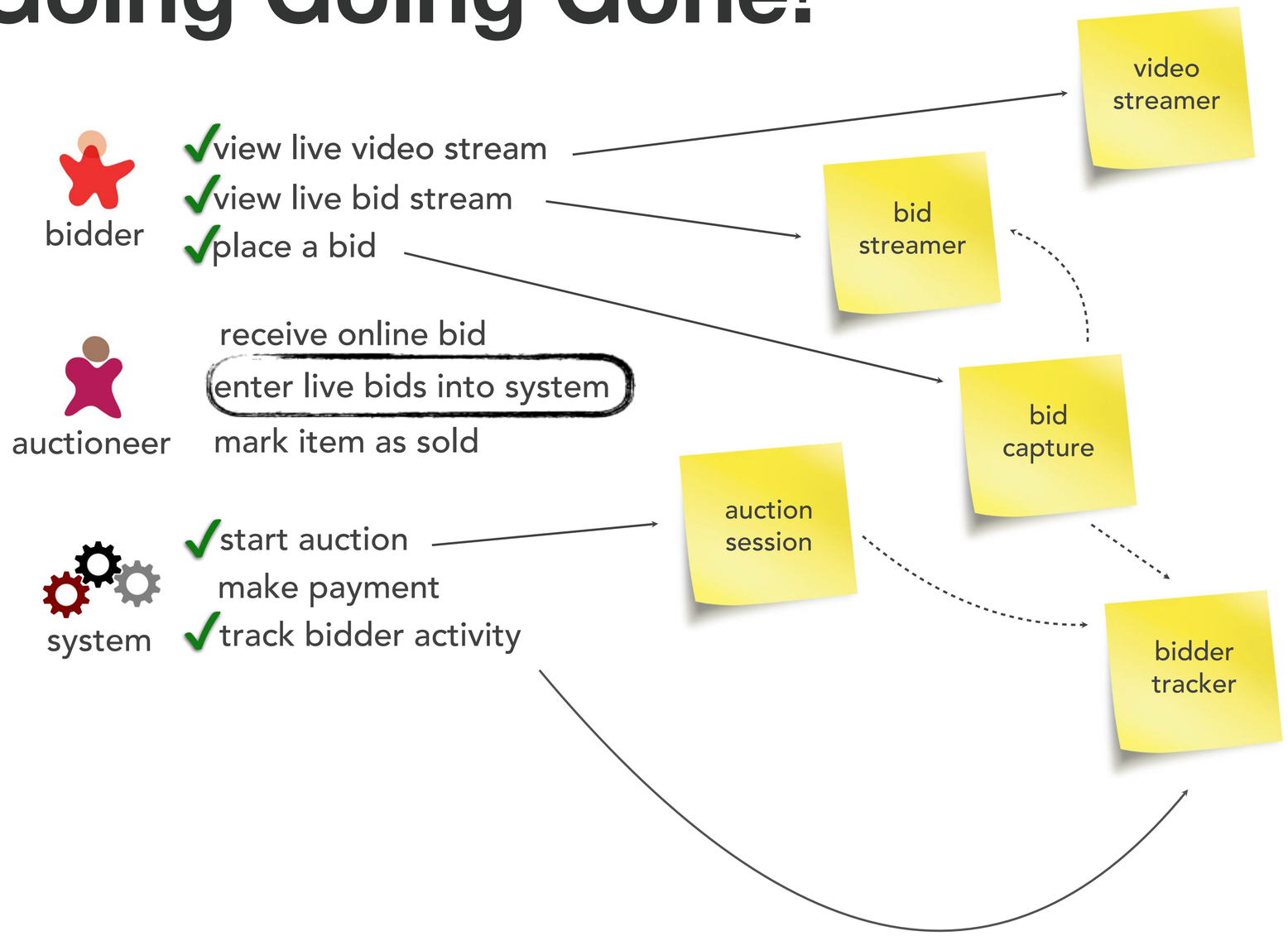

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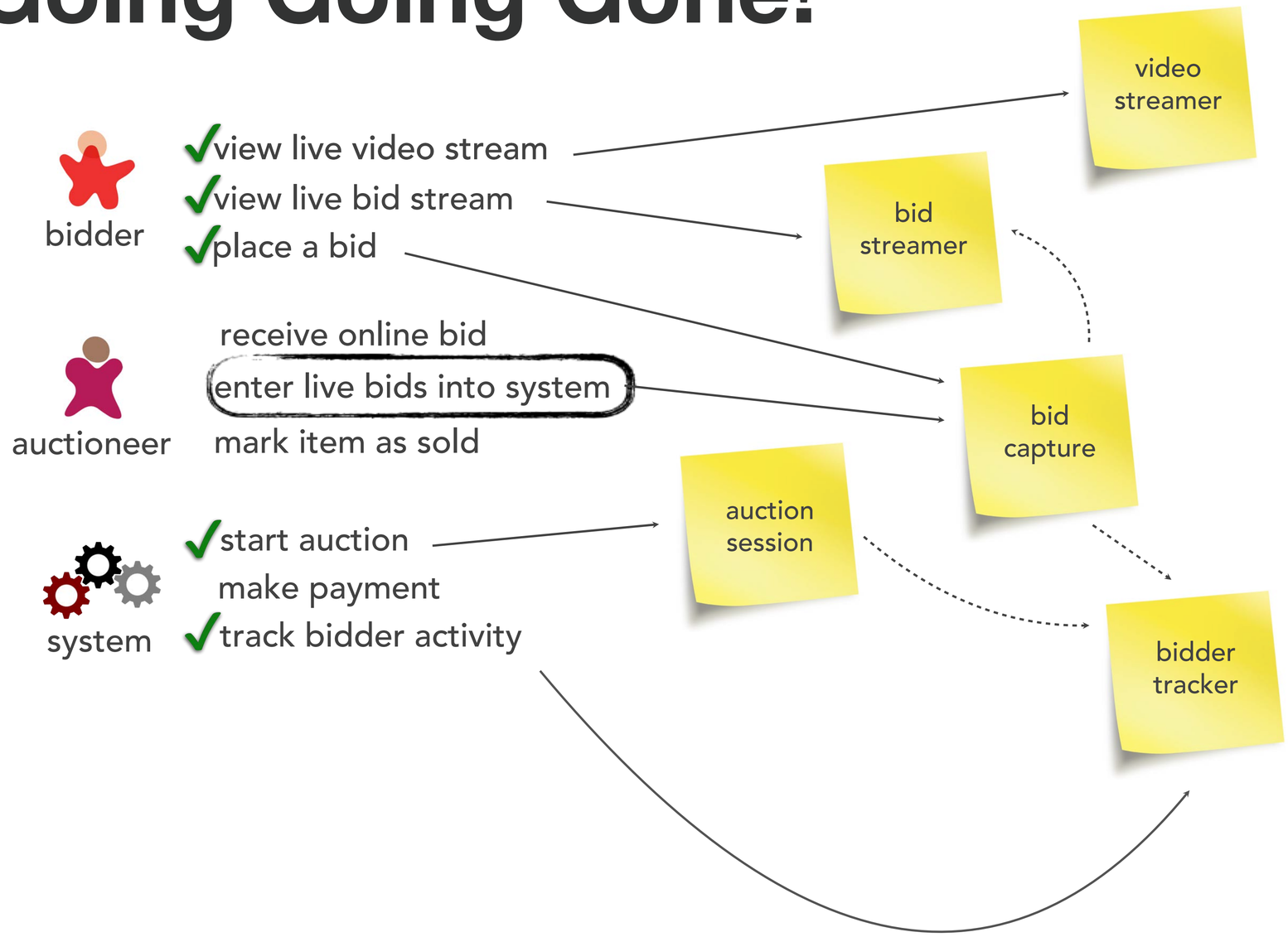

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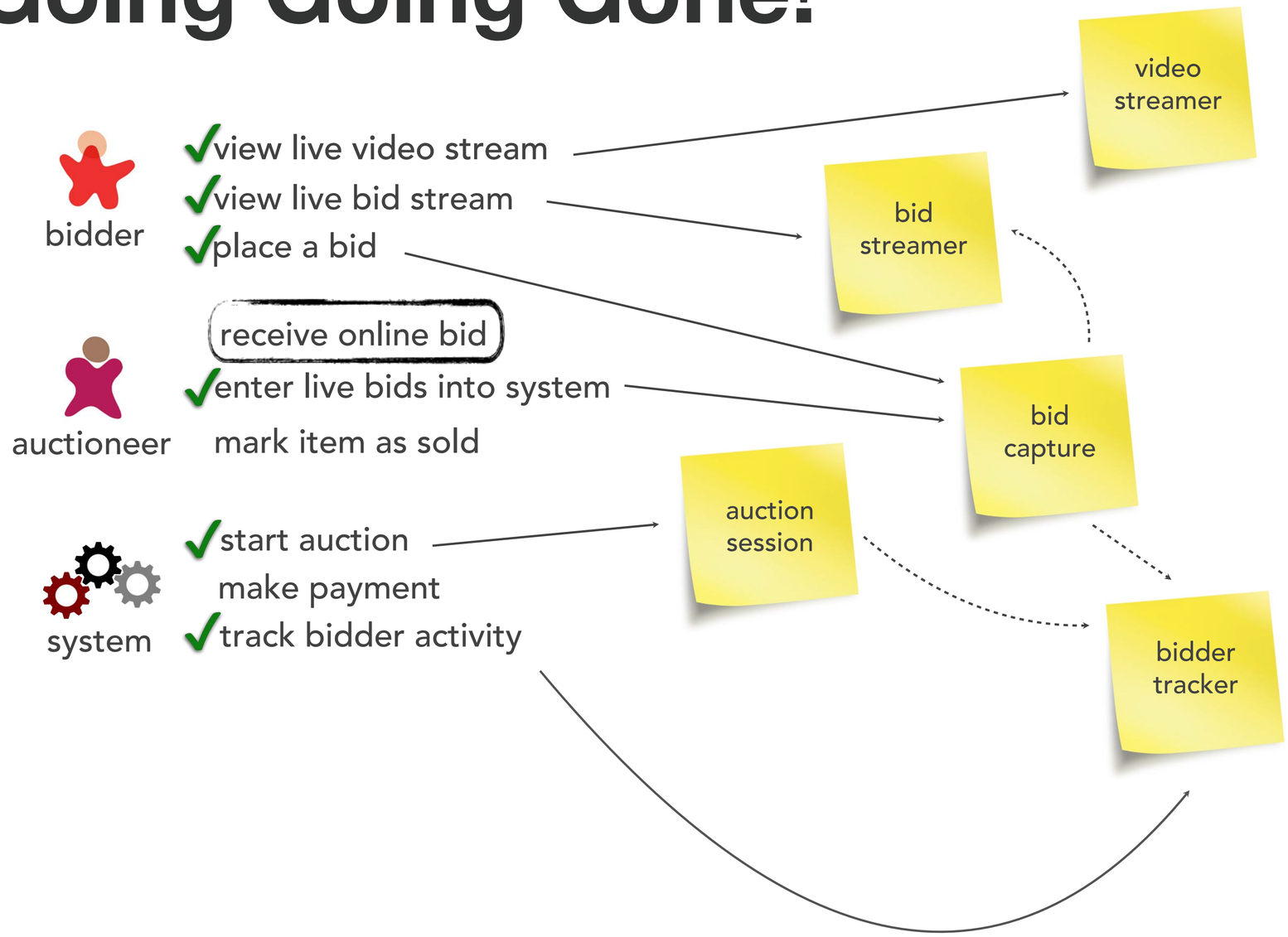

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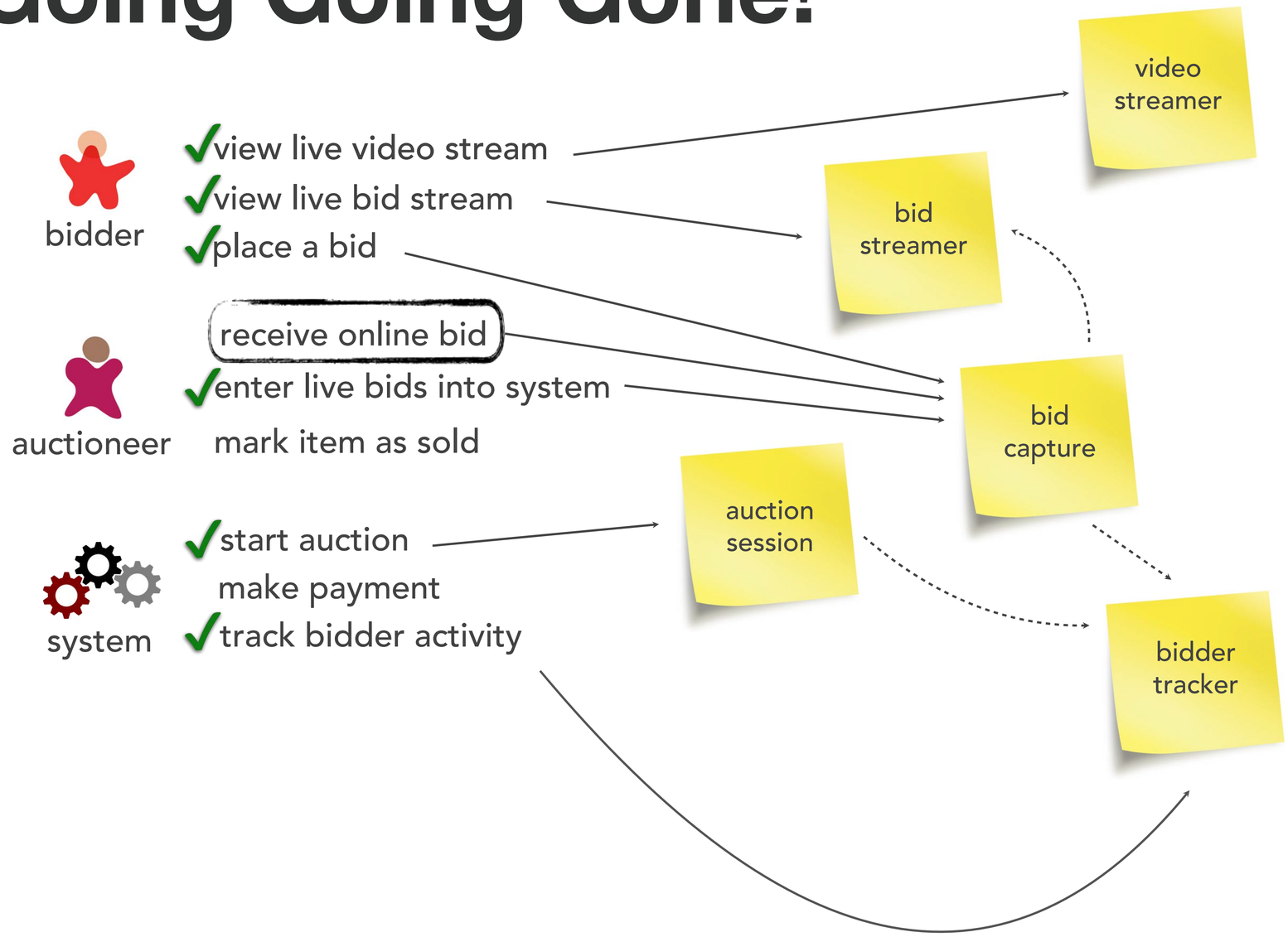

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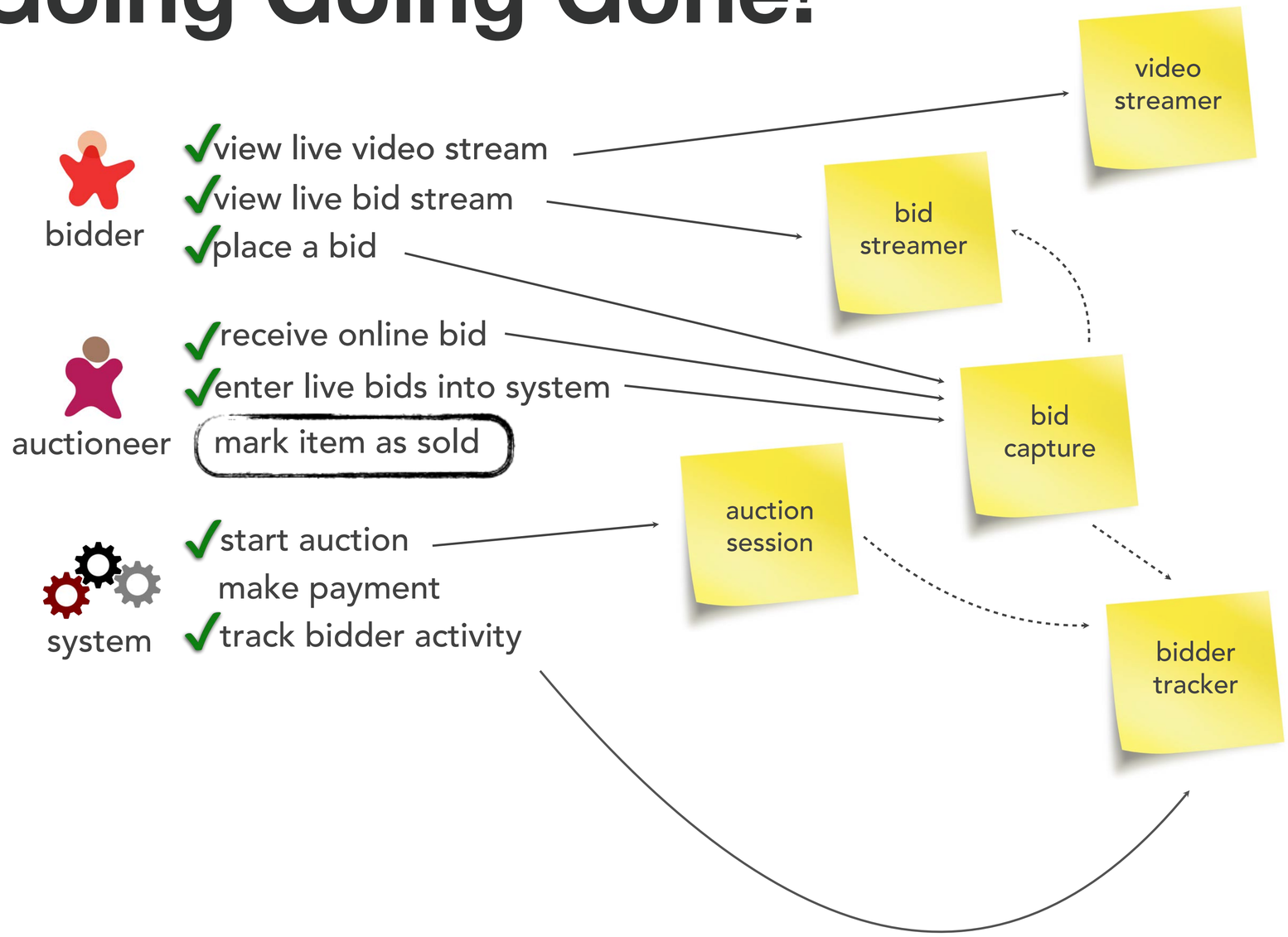

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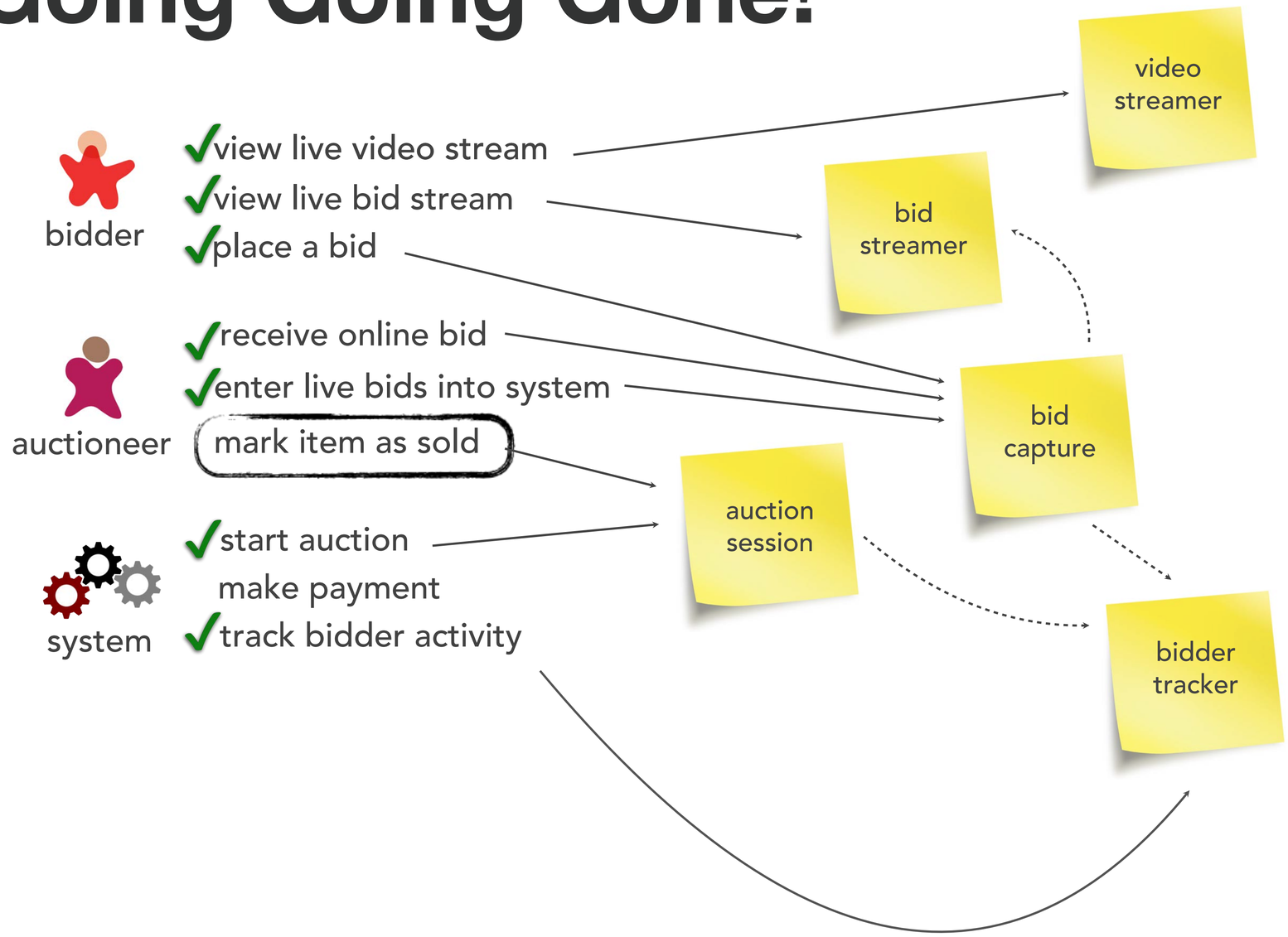

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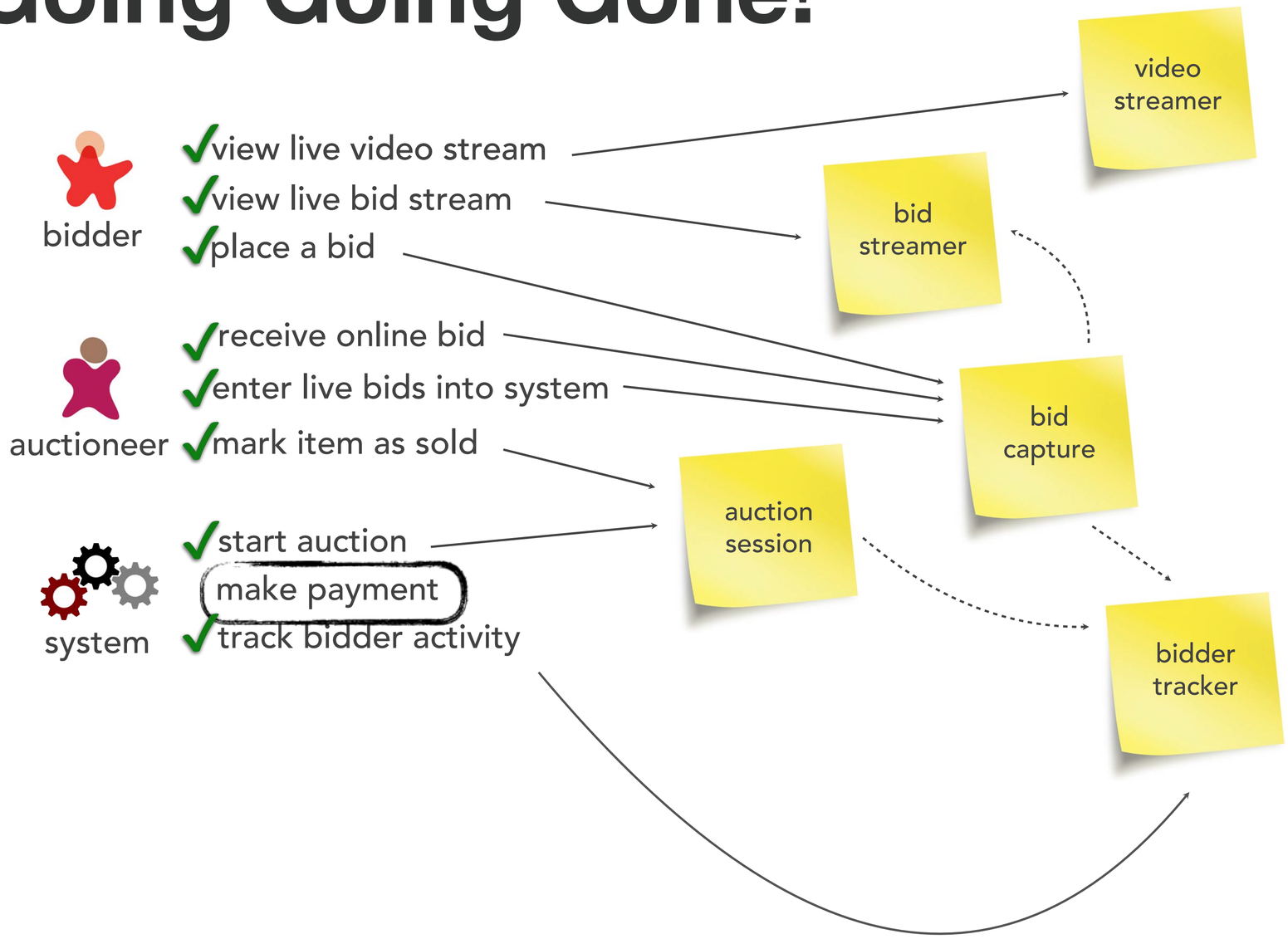

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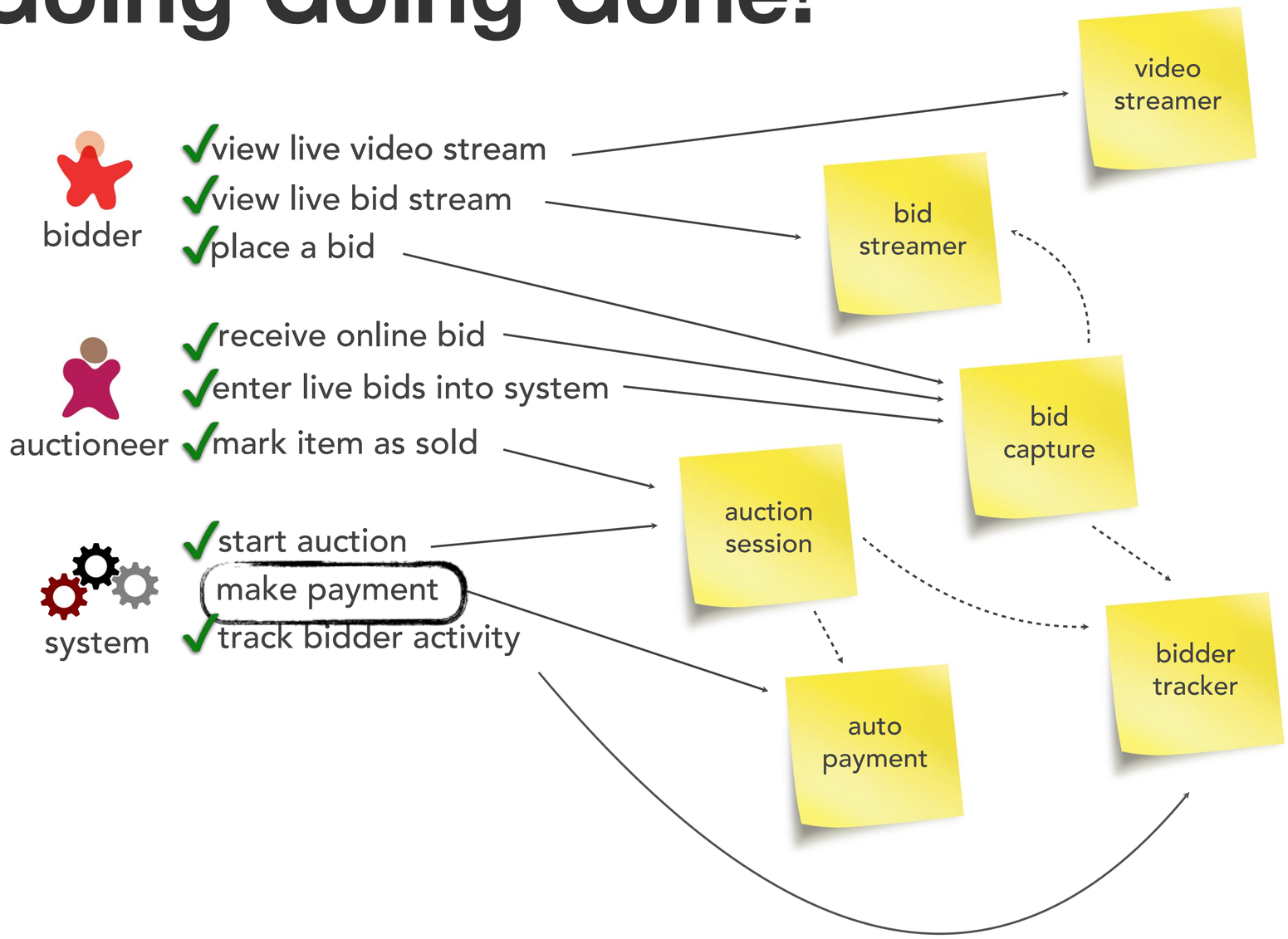

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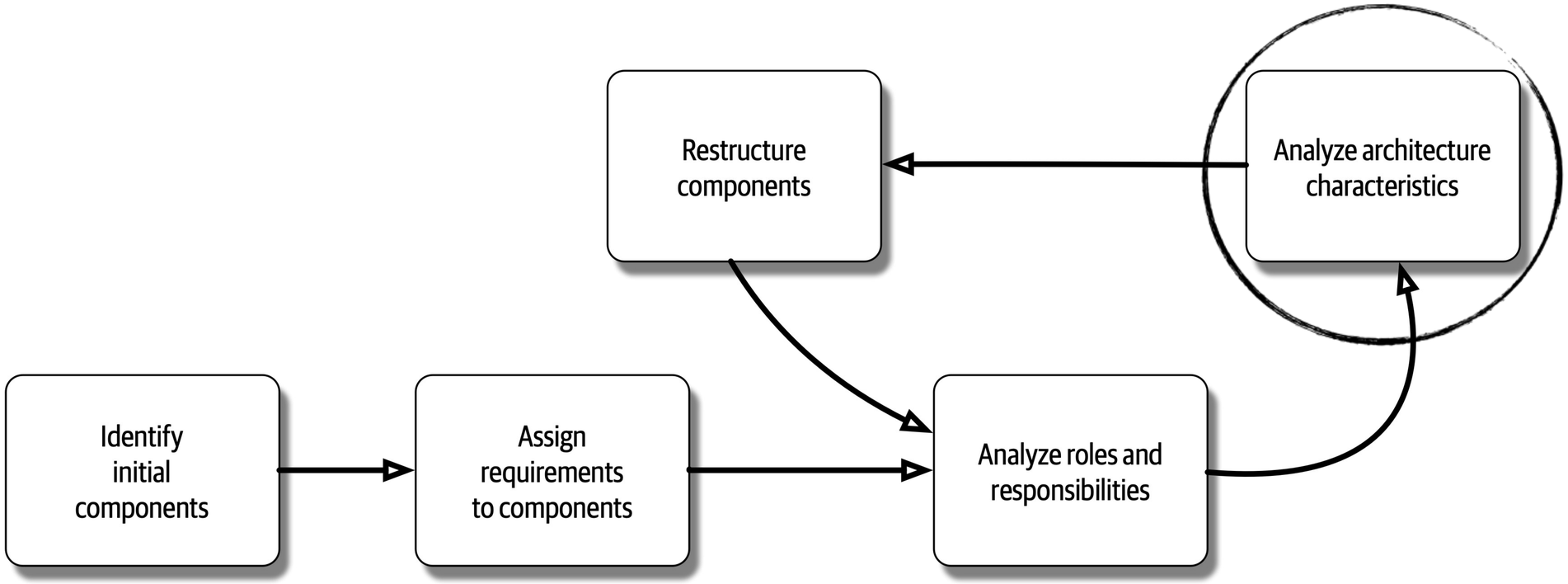

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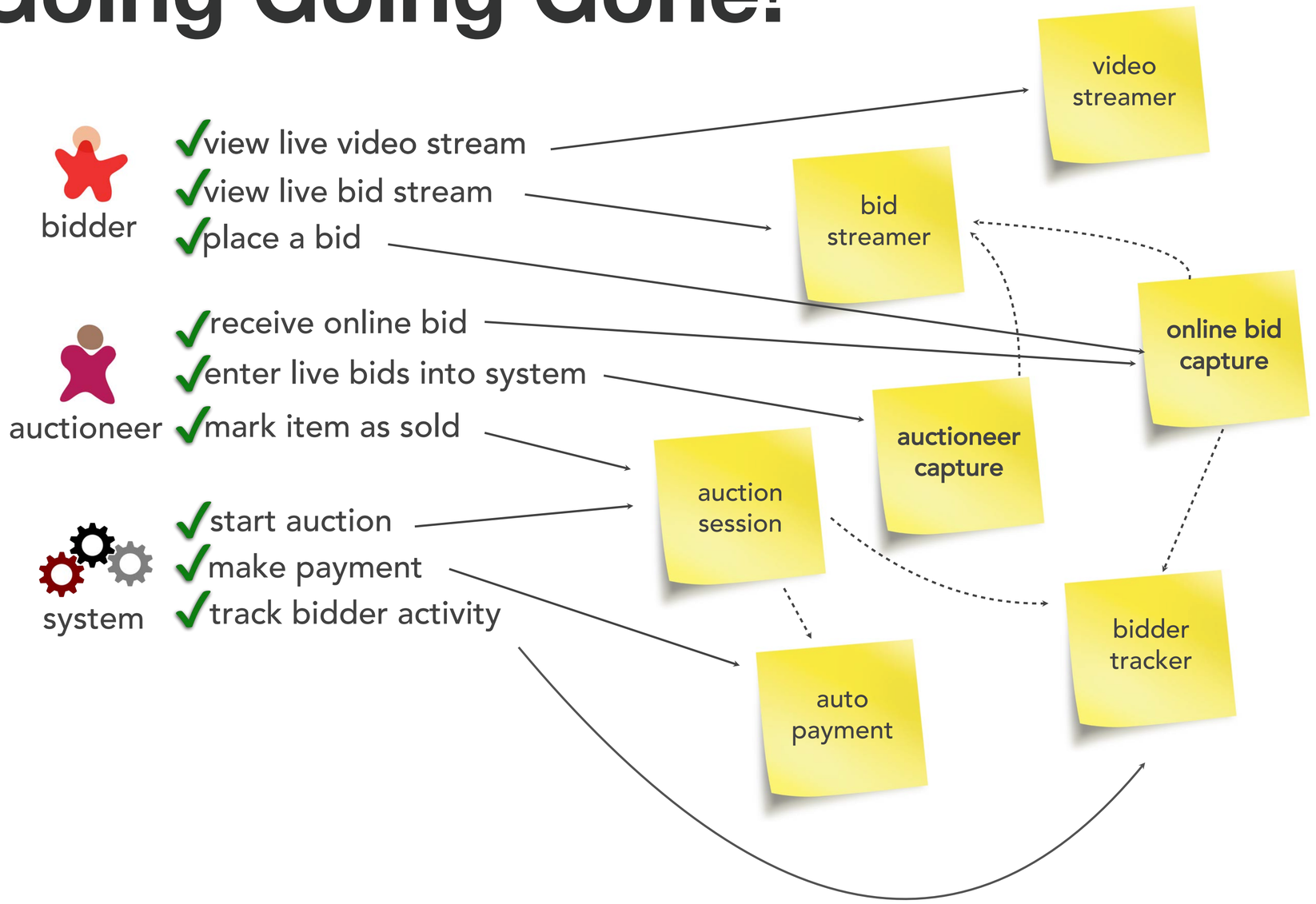

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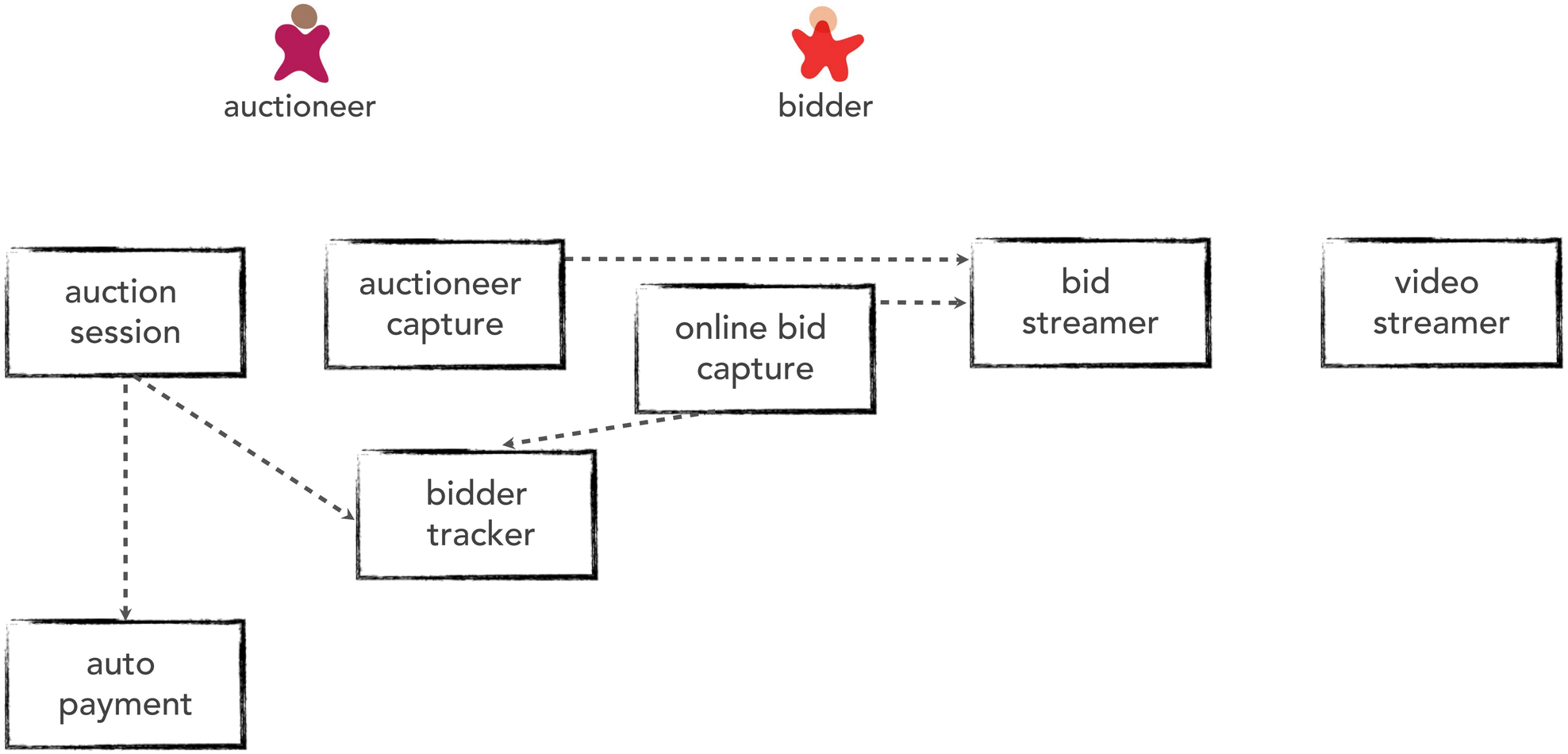

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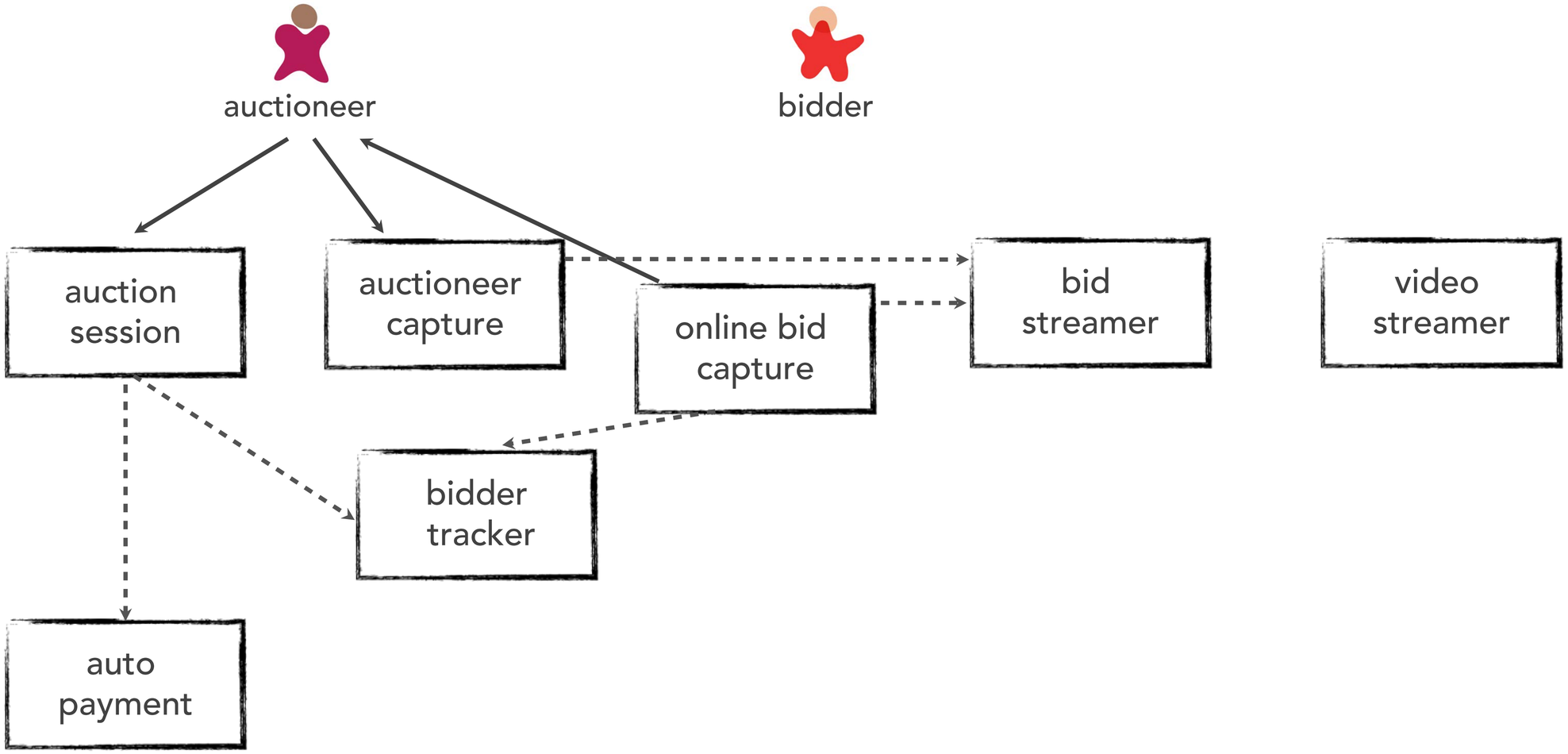

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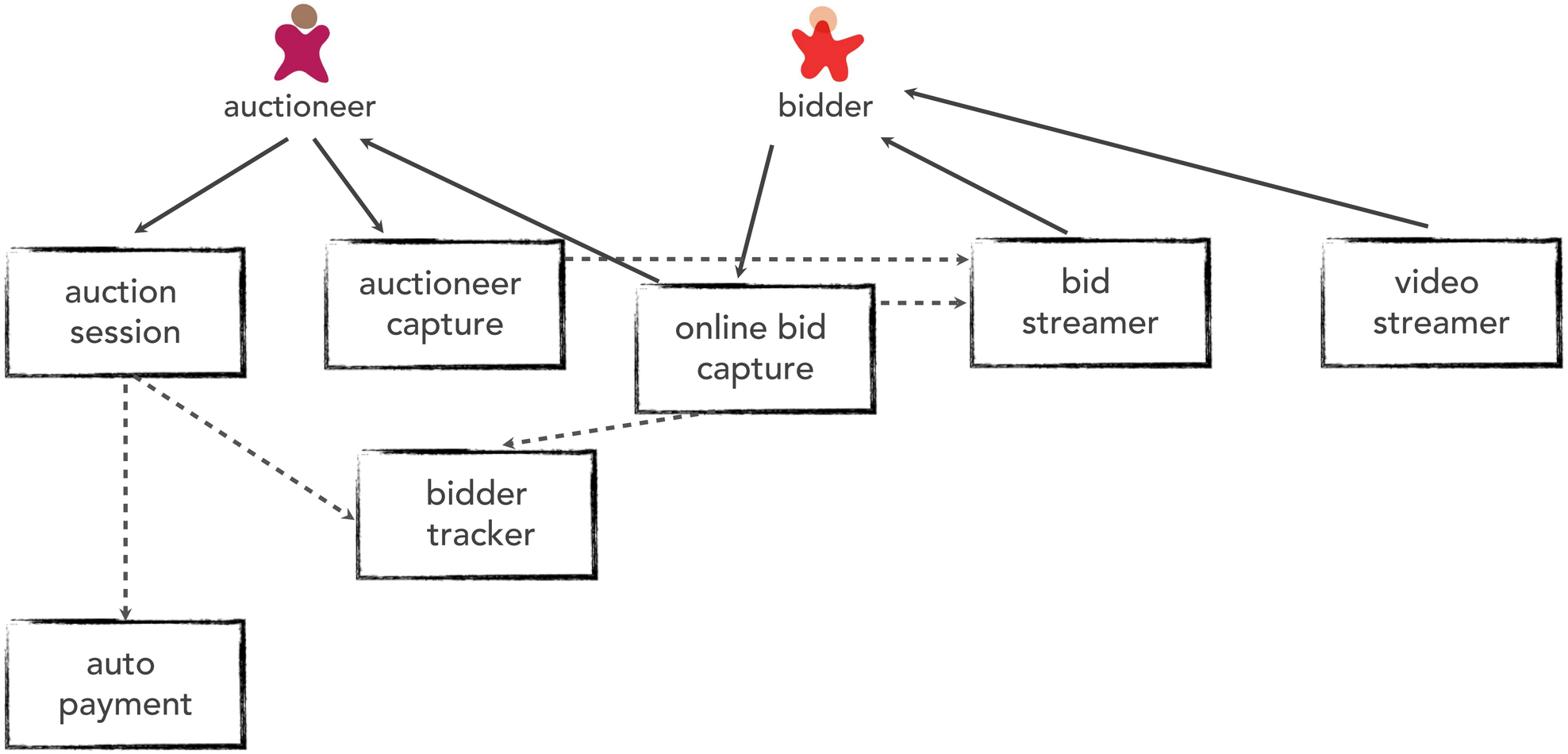

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Silicon Sandwiches

A national sandwich shop wants to enable internet-ordering (in addition to their current call-in service)

- ***Users:*** thousands, perhaps one day millions
- ***Requirements:***
  - users will place their order, then be given a time to pick up their sandwich and directions to the shop (which must integrate with several external mapping services that include traffic information)
  - if the shop offers a delivery service, dispatch the driver with the sandwich to the user
  - mobile-device accessibility
  - offer national daily promotions/specials
  - offer local daily promotions/specials
  - accept payment online or in person/on delivery
- ***Additional Context:***
  - Sandwich shops are franchised, each with a different owner.
  - Parent company has near-future plans to expand overseas.
  - Corporate goal is to hire inexpensive labor to maximize profit.
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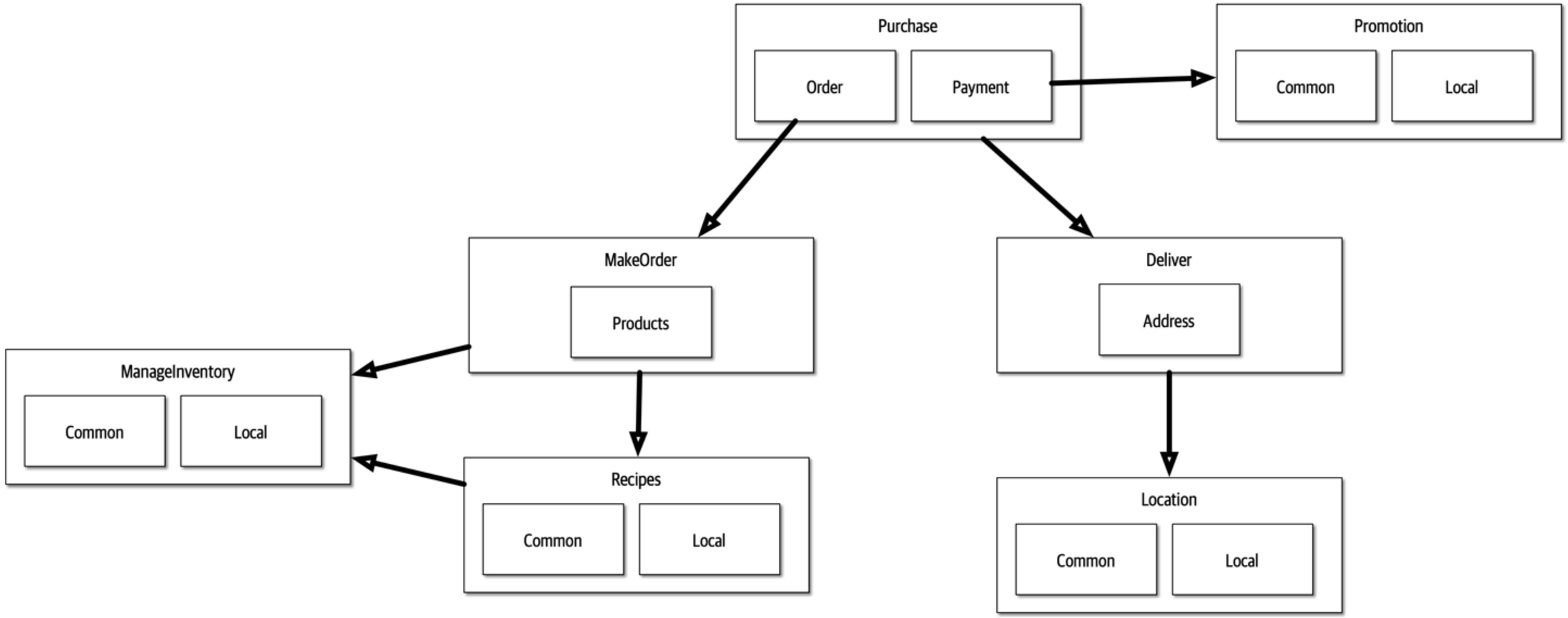
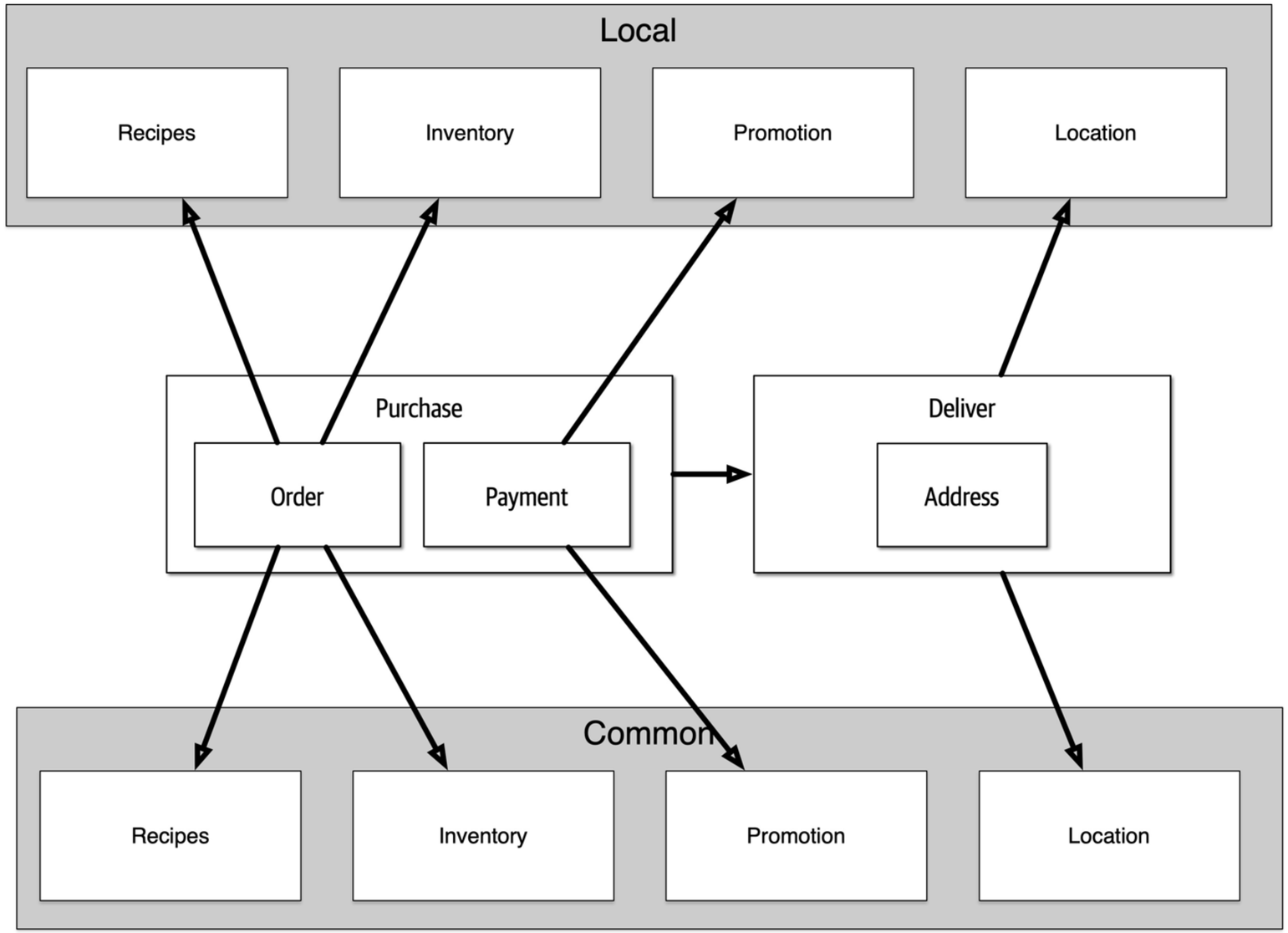
Silicon Sandwiches



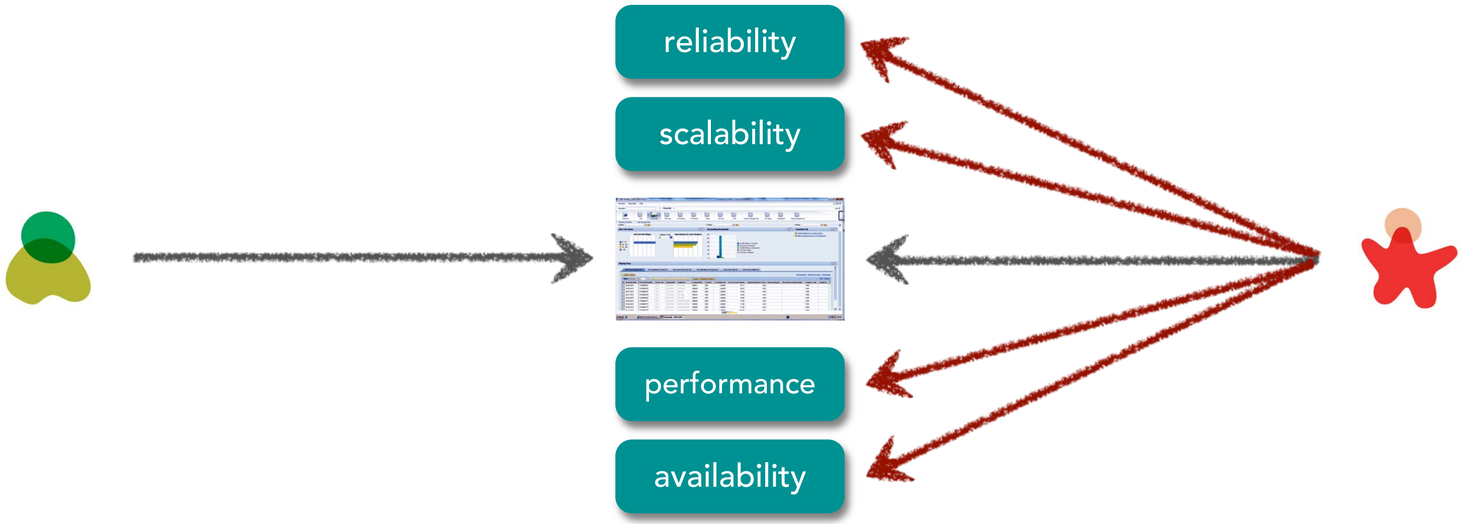
Your Architectural Kata is...

Silicon Sandwiches



architecture characteristics scope?

Differing architecture characteristics
for groups of components =>
distributed architecture.



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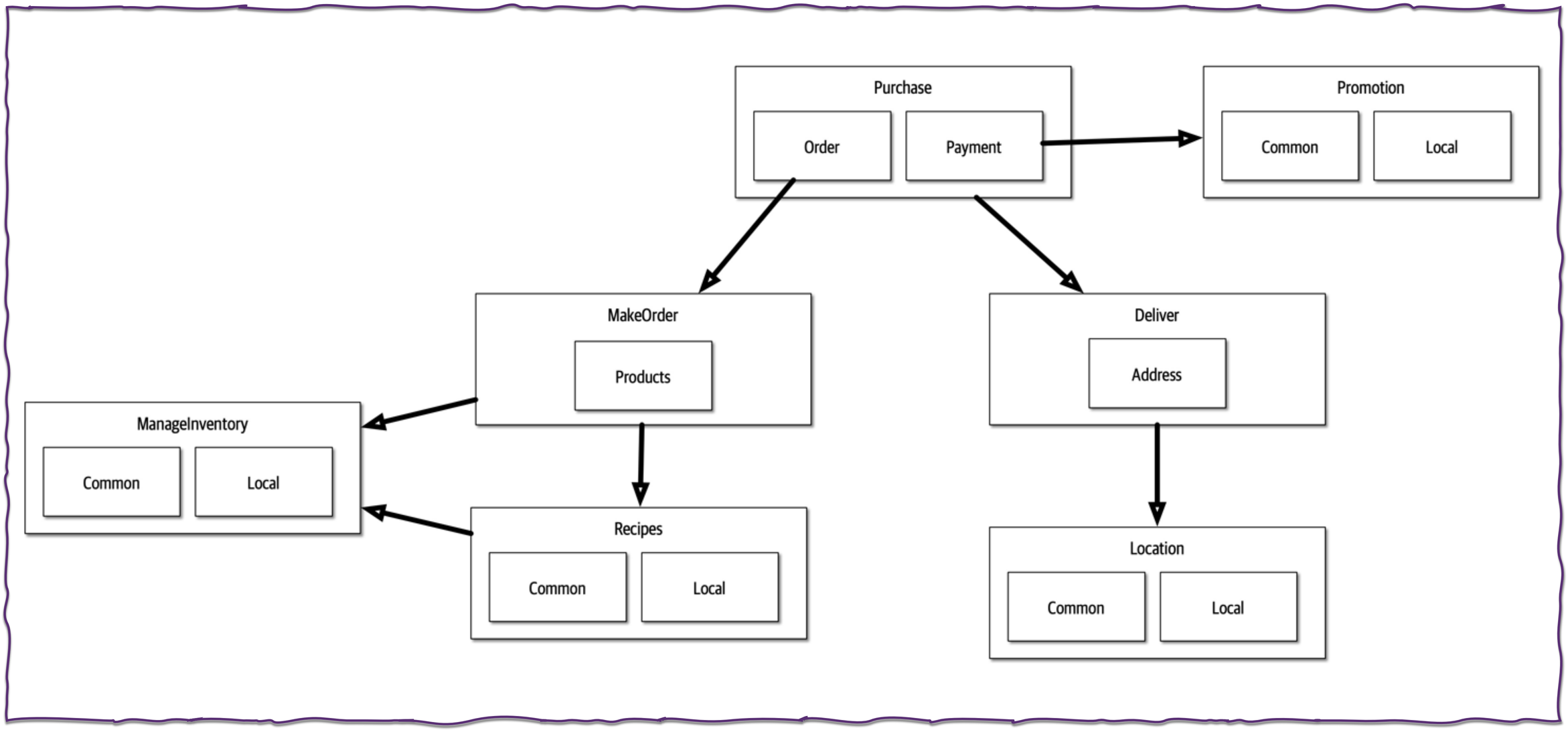
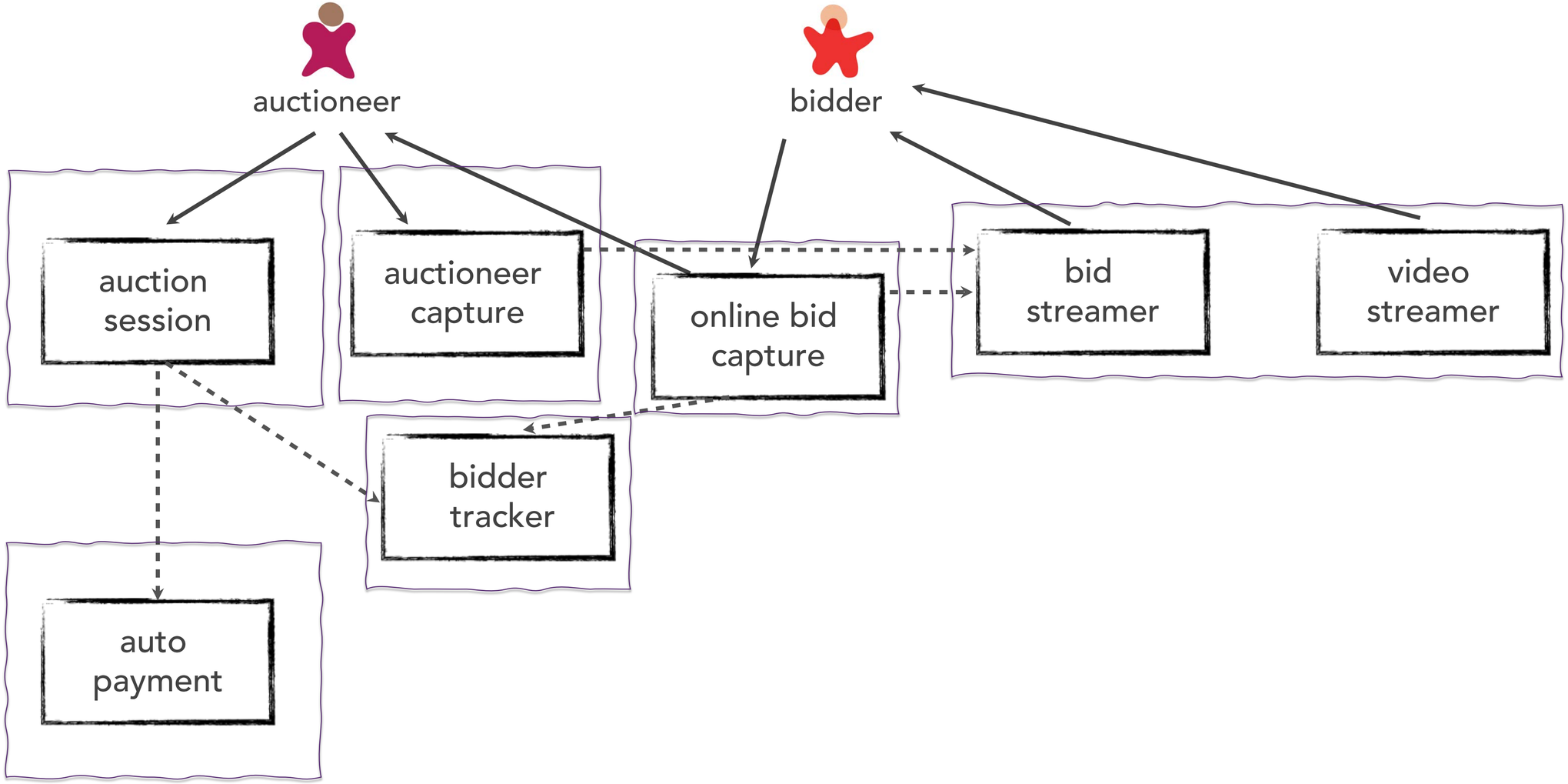
Silicon Sandwiches



Your Architectural Kata is...

Going Going Gone!



architecture katas

identifying architecture styles

Your Architectural Kata is...

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An auction company wants to take their auctions online to a nationwide scale--customers choose the auction to participate in, wait until the auction begins, then bid during the live auction as if they were there in the room, with the auctioneer.

- **Users**: scale up to hundreds of participants (per auction), potentially up to thousands of participants, and as many simultaneous auctions as possible
- **Requirements**:
  - bidders can see a live video stream of the auction and see all bids as they occur
  - auctions must be as real-time as possible
  - both online and live bids must be received in the order in which they are placed
  - video stream of the action after the fact
  - bidders register with credit card; system automatically charges card if bidder wins
  - participants must be tracked via a reputation index
- **Additional Context:**
  - auction company is expanding aggressively by merging with smaller competitors
  - if nationwide auction is a success, replicate the model overseas
  - budget is not constrained--this is a strategic direction
  - company just exited a lawsuit where they settled a suit alleging fraud

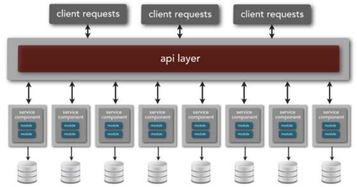
Your Architectural Kata is...

Silicon Sandwiches

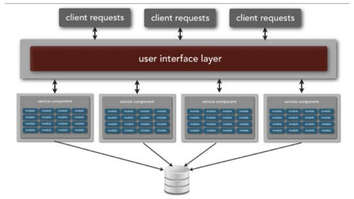
A national sandwich shop wants to enable 'fax in your order' but over the Internet instead (in addition to their current fax-in service)

- ***Users:*** thousands, perhaps one day millions
- ***Requirements:***
  - users will place their order, then be given a time to pick up their sandwich and directions to the shop (which must integrate with several external mapping services that include traffic information)
  - if the shop offers a delivery service, dispatch the driver with the sandwich to the user
  - mobile-device accessibility
  - offer national daily promotionals/specials
  - offer local daily promotionals/specials
  - accept payment online or in person/on delivery
- ***Additional Context:***
  - Sandwich shops are franchised, each with a different owner.
  - Parent company has near-future plans to expand overseas.
  - Corporate goal is to hire inexpensive labor to maximize profit.

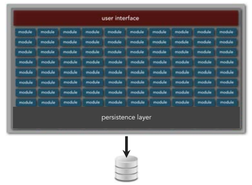
architecture styles help define the basic characteristics and behavior of an application



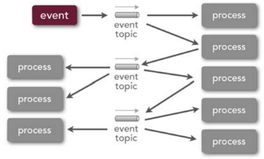
microservices architecture



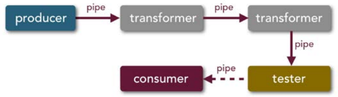
service-based architecture



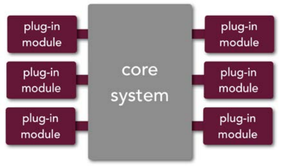
layered architecture



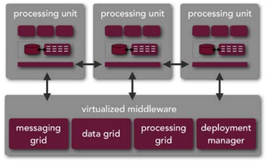
event-driven architecture



pipeline architecture



microkernel architecture



space-based architecture

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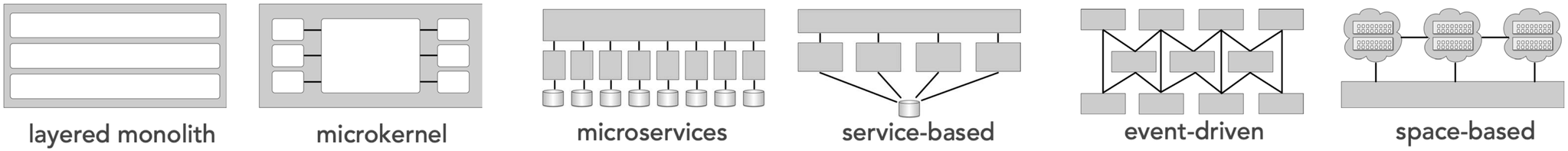
availability reliability performance scalability elasticity concurrency (security)

Your Architectural Kata is...

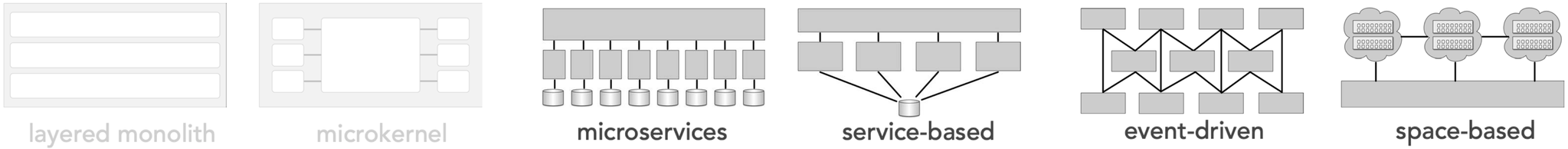
Going Going Gone!



	layered monolith	microkernel	microservices	service-based	event-driven	space-based
agility	★	★★★	★★★★★	★★★★	★★★★	★★★
deployment	★	★★★	★★★★★	★★★★	★★★	★★★
testability	★★	★★★	★★★★★	★★★★	★★	★
performance	★★★	★★★	★★	★★★	★★★★★	★★★★★
scalability	★	★	★★★★★	★★★	★★★★	★★★★★
elasticity	★	★	★★★★	★★	★★★	★★★★★
simplicity	★★★★★	★★★★	★	★★★	★	★
fault-tolerance	★	★	★★★★★	★★★★	★★★★★	★★★
evolvability	★	★★★	★★★★★	★★★★	★★★★★	★★★
total cost	★★★★★	★★★★★	★	★★★★	★★★	★★

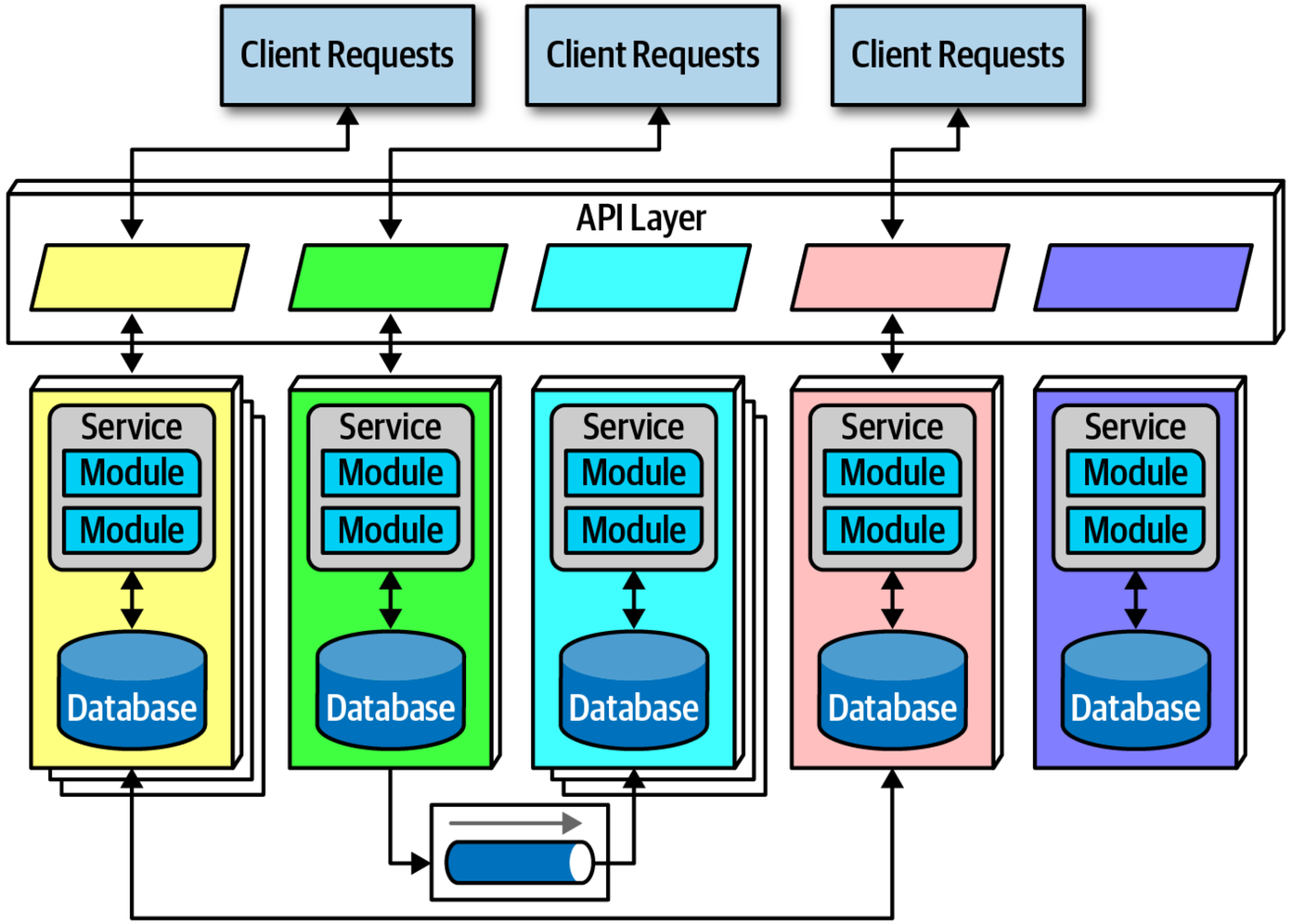
Your Architectural Kata is...

Going Going Gone!



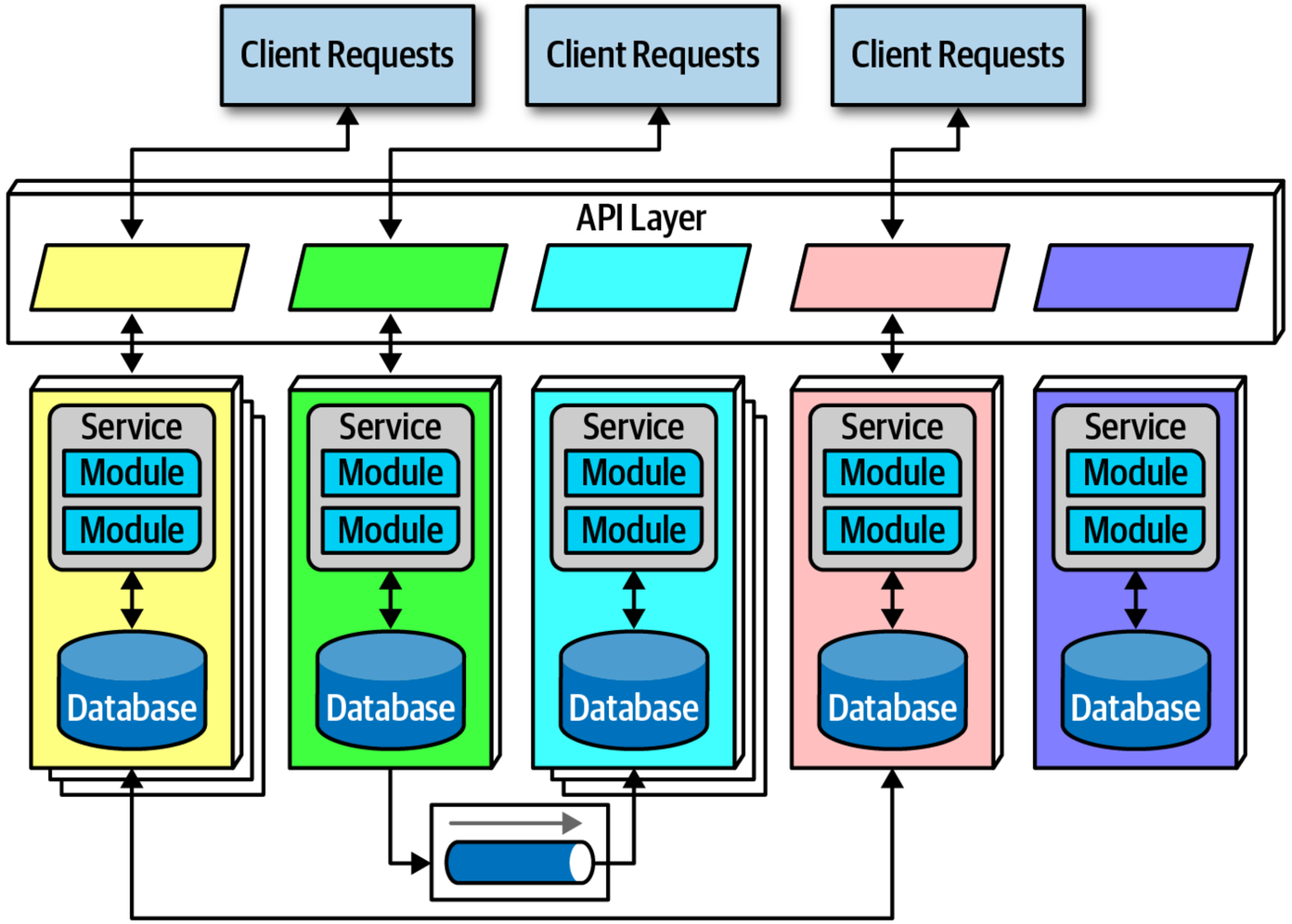
	layered monolith	microkernel	microservices	service-based	event-driven	space-based
agility	★	★★★	★★★★★	★★★★	★★★★	★★★
deployment	★	★★★	★★★★★	★★★★	★★★	★★★
testability	★★	★★★	★★★★★	★★★★	★★	★
performance	★★★	★★★	★★	★★★	★★★★★	★★★★★
scalability	★	★	★★★★★	★★★	★★★★	★★★★★
elasticity	★	★	★★★★	★★	★★★	★★★★★
simplicity	★★★★★	★★★★	★	★★★	★	★
fault-tolerance	★	★	★★★★★	★★★★	★★★★★	★★★
evolvability	★	★★★	★★★★★	★★★★	★★★★★	★★★
total cost	★★★★★	★★★★★	★	★★★★	★★★	★★

microservices

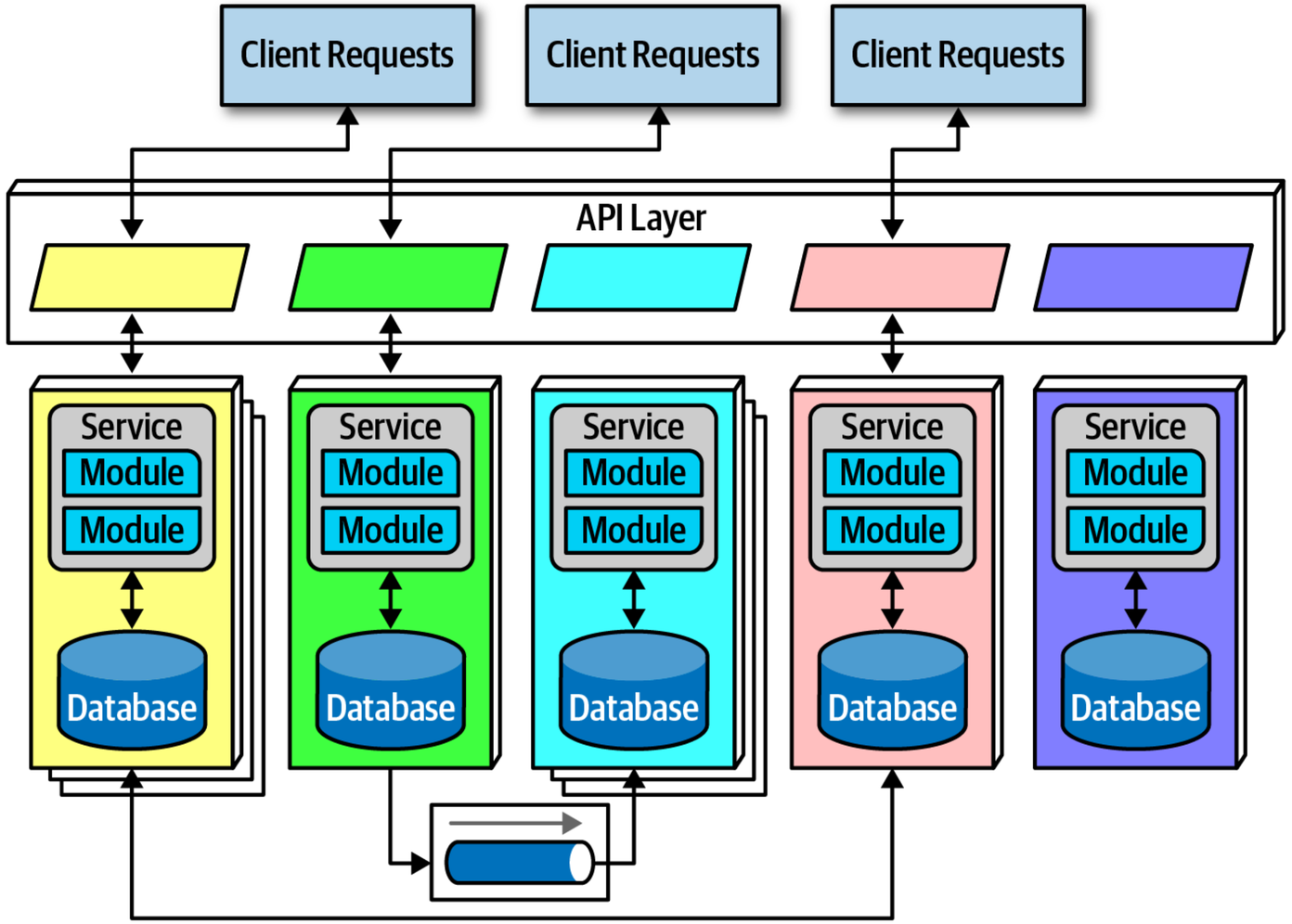


microservices

distributed architecture



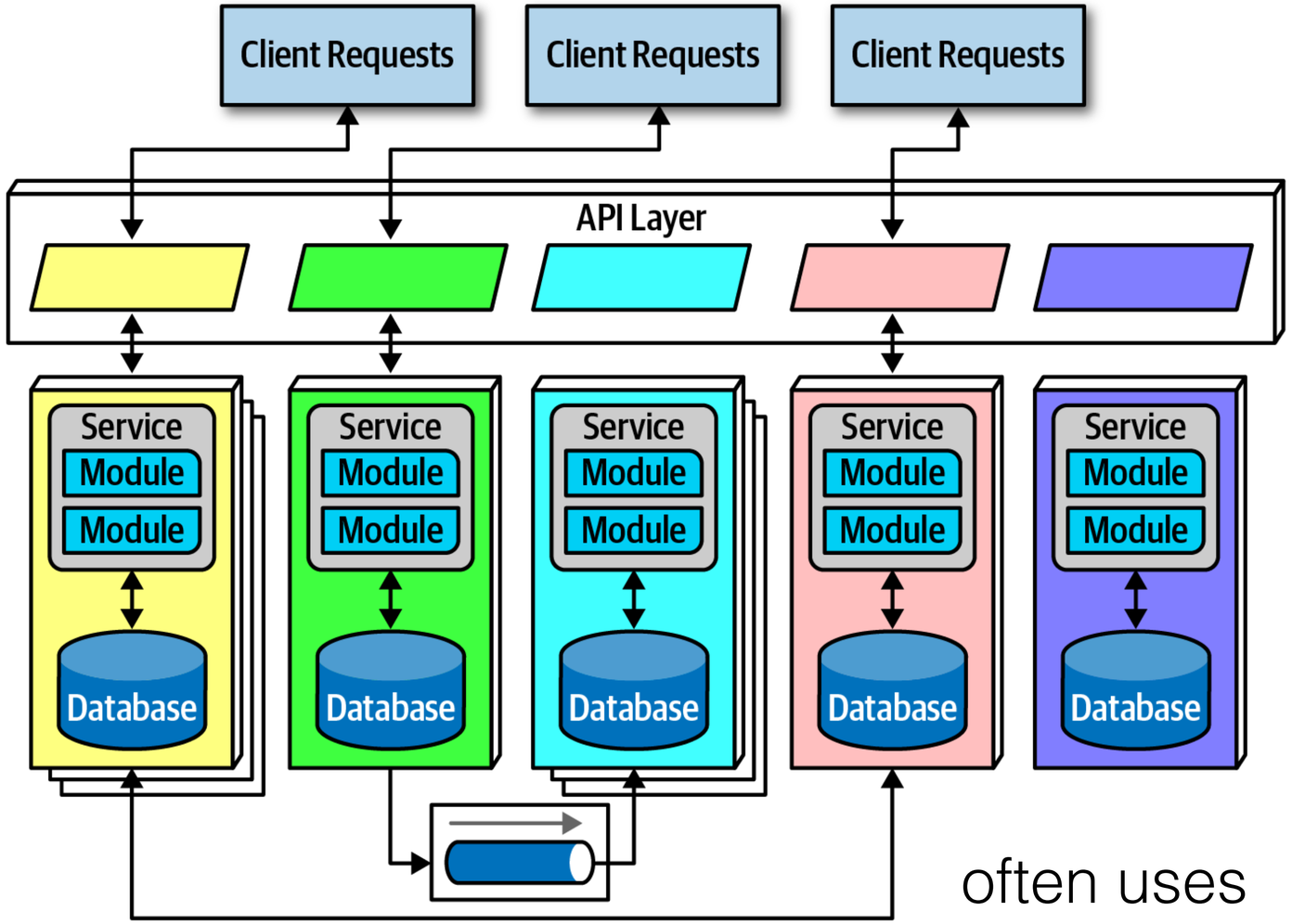
microservices



includes data

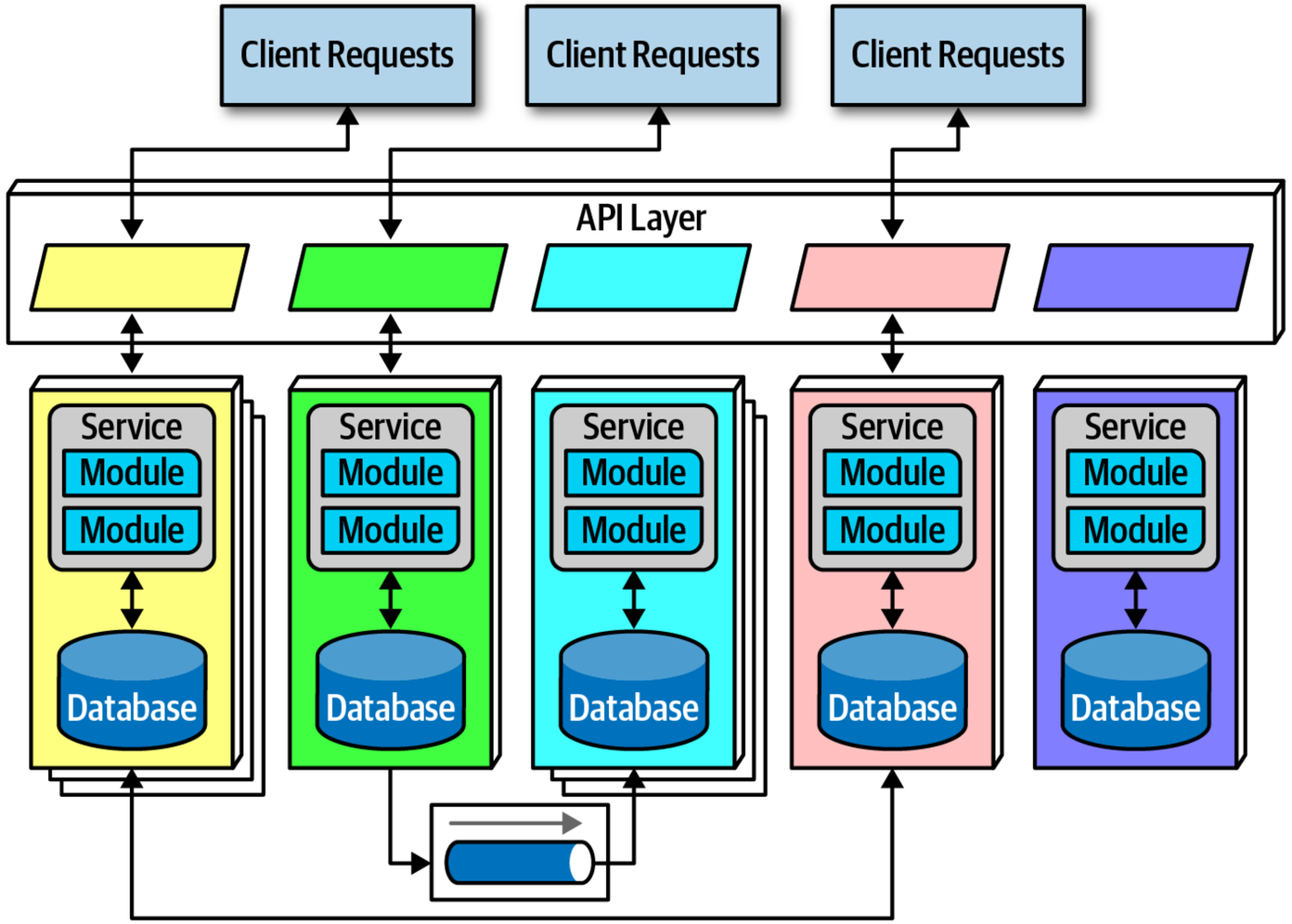
bounded context

microservices



often uses events

suitability: microservices ?



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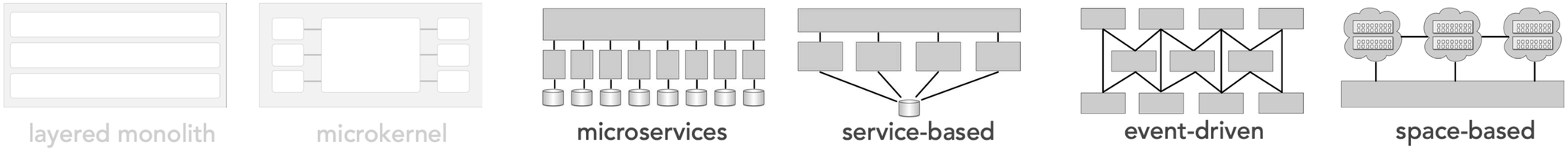
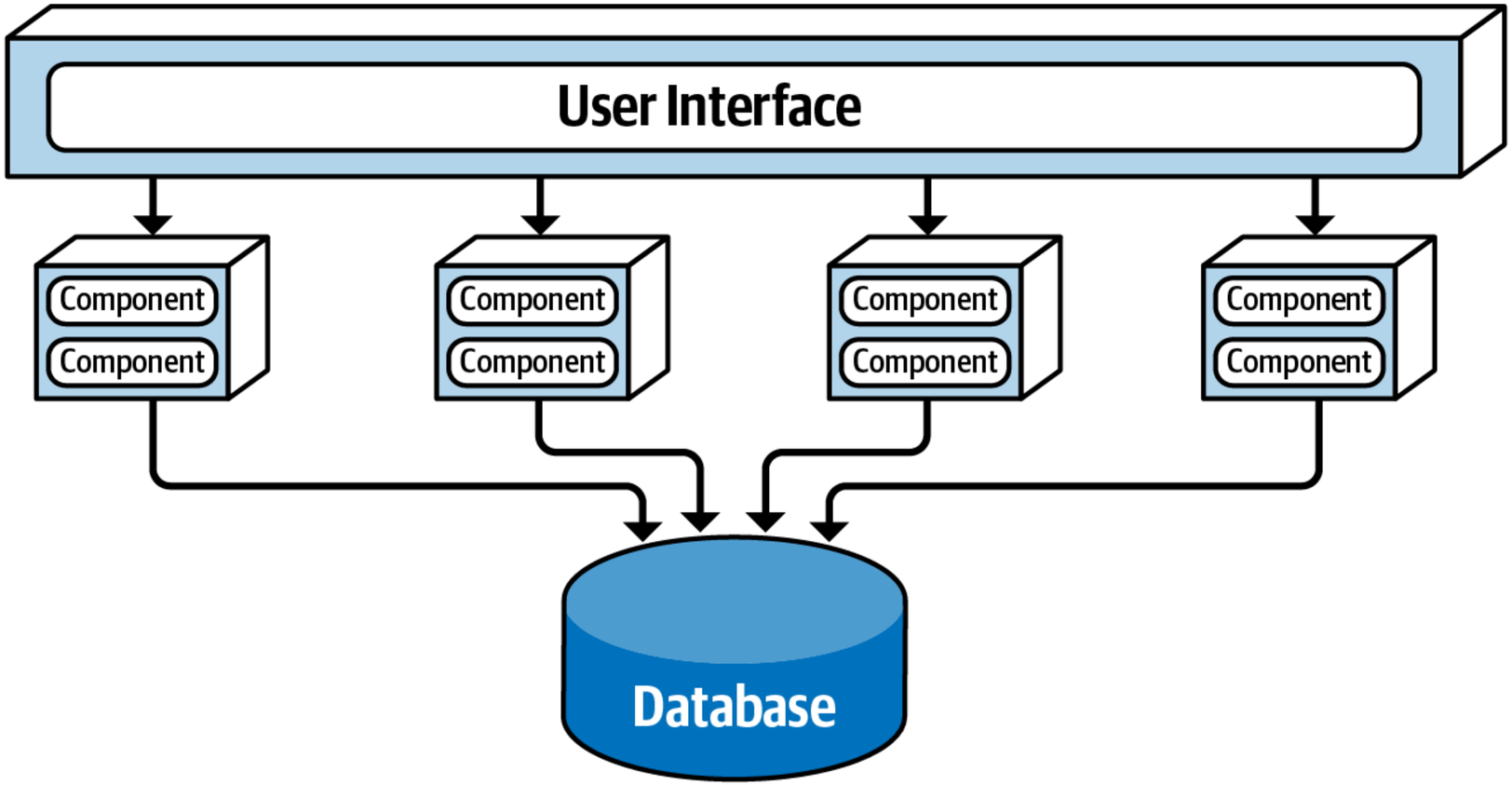
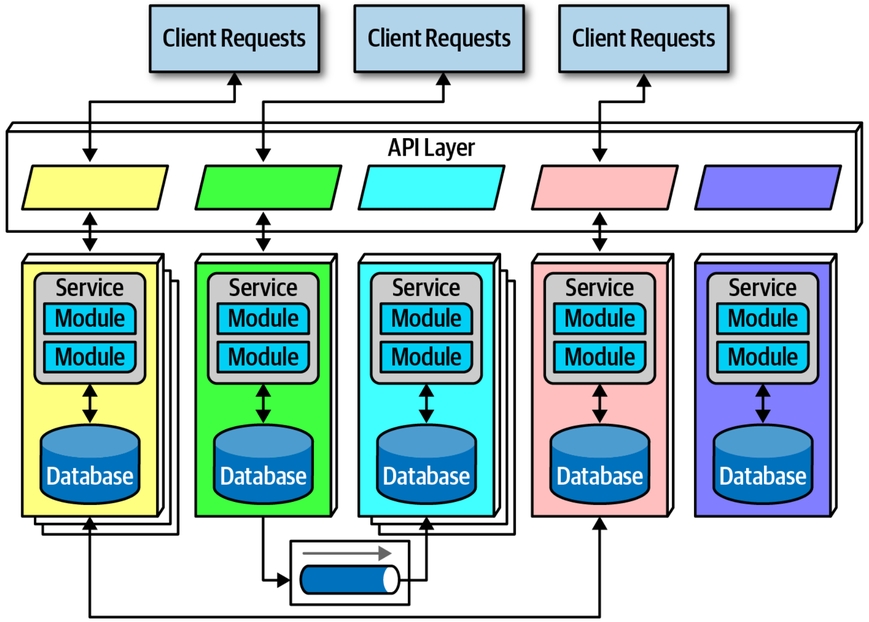


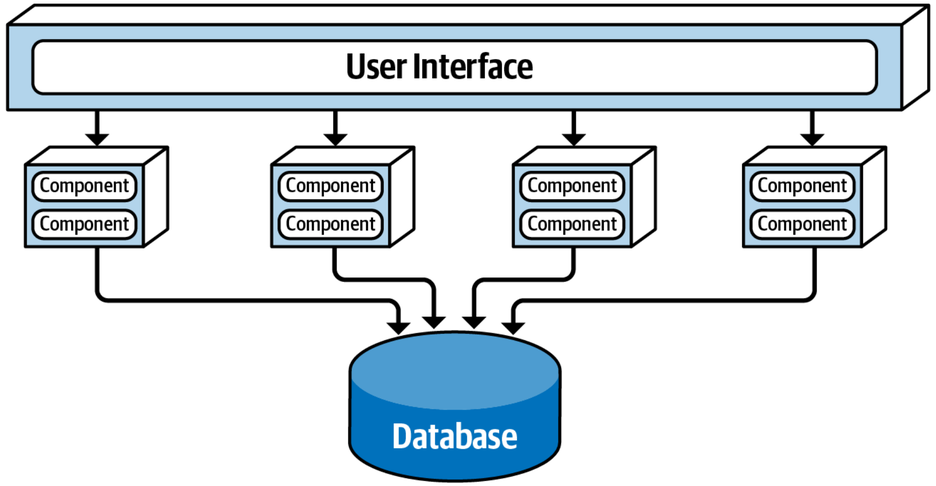
	layered monolith	microkernel	microservices	service-based	event-driven	space-based
agility	★	★★★	★★★★★	★★★★	★★★★	★★★
deployment	★	★★★	★★★★★	★★★★	★★★	★★★
testability	★★	★★★	★★★★★	★★★★	★★	★
performance	★★★	★★★	★★	★★★	★★★★★	★★★★★
scalability	★	★	★★★★★	★★★	★★★★	★★★★★
elasticity	★	★	★★★★	★★	★★★	★★★★★
simplicity	★★★★★	★★★★	★	★★★	★	★
fault-tolerance	★	★	★★★★★	★★★★	★★★★★	★★★
evolvability	★	★★★	★★★★★	★★★★	★★★★★	★★★
total cost	★★★★★	★★★★★	★	★★★★	★★★	★★

service-based architecture

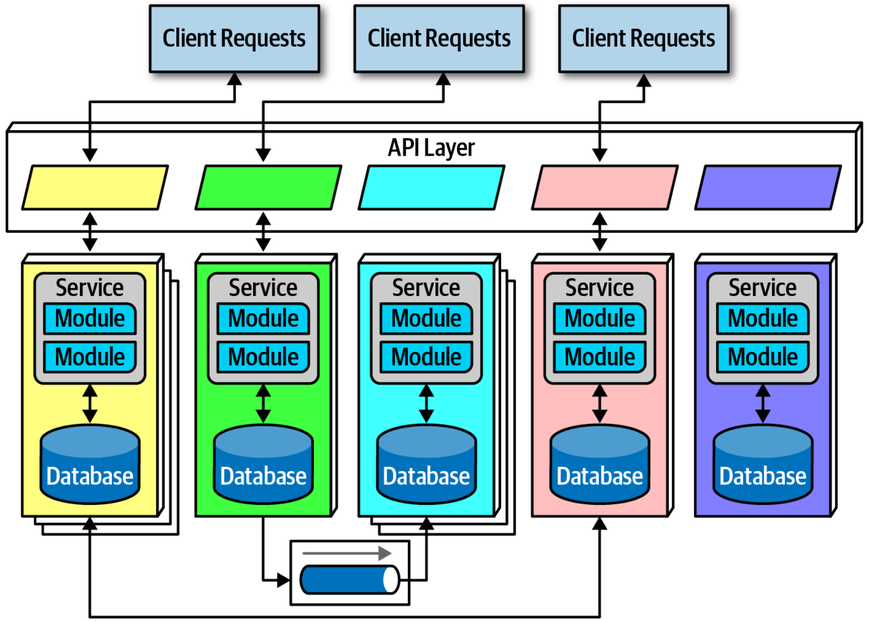


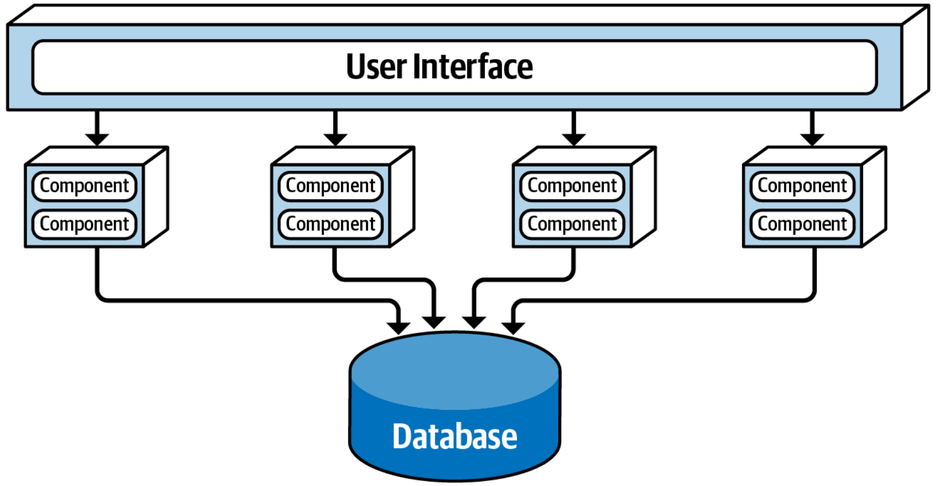
microservices vs service-based





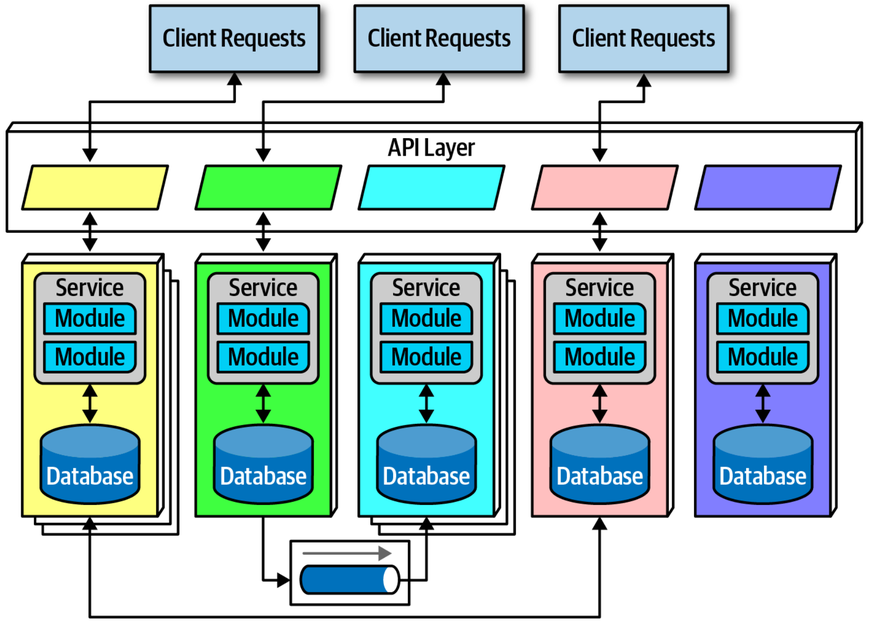
microservices vs service-based

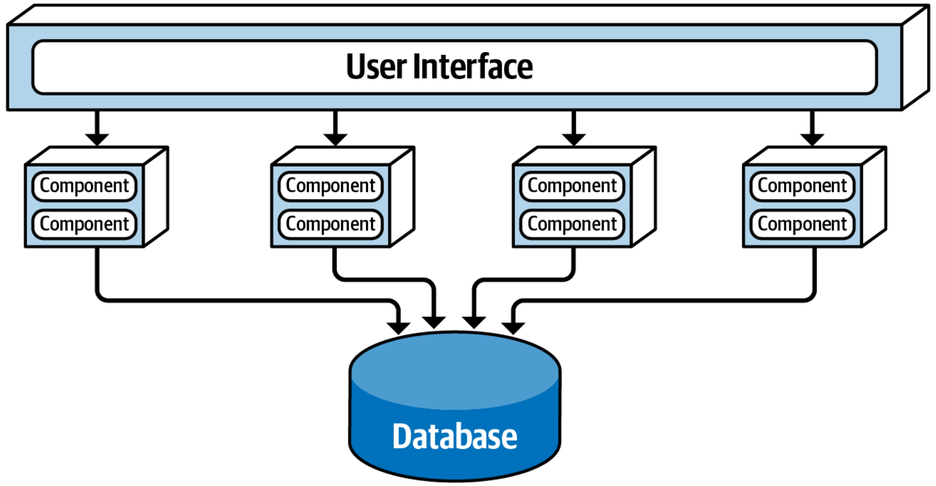




database(s)

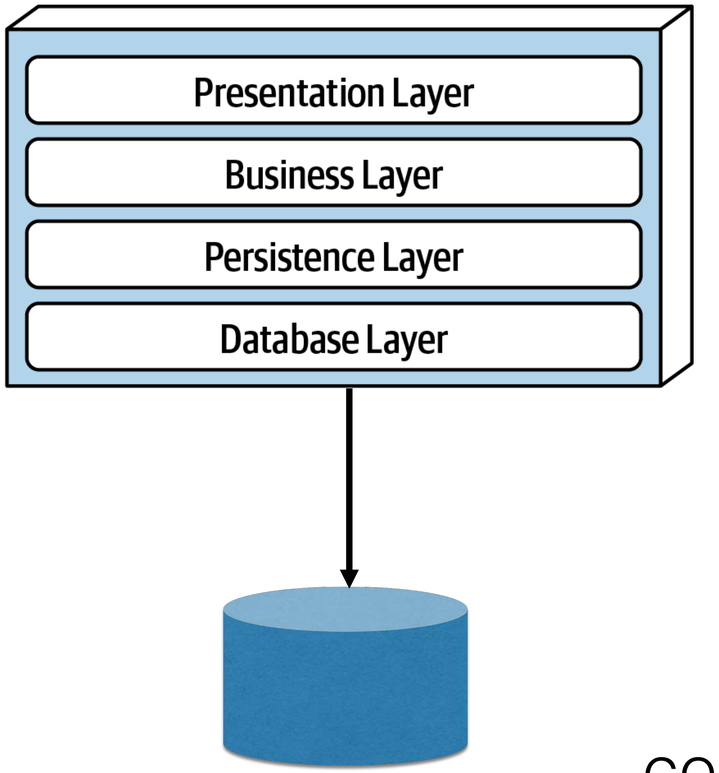
microservices vs service-based

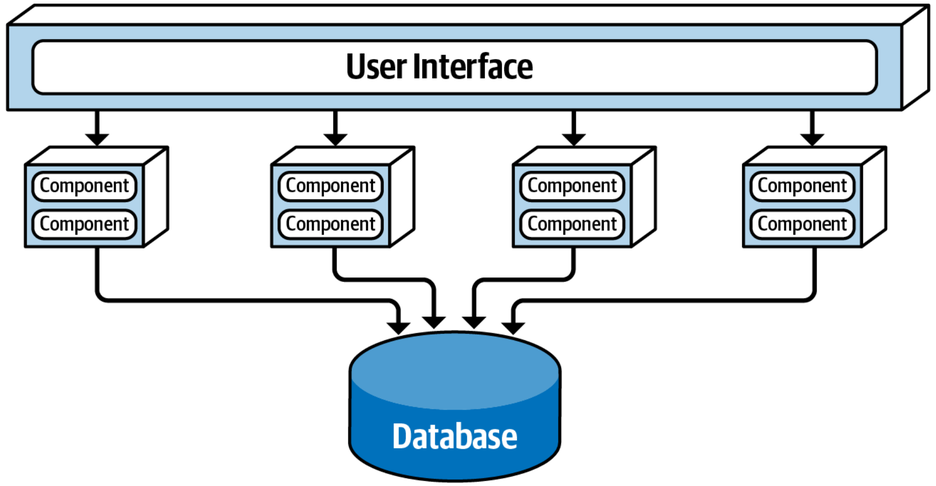




service granularity

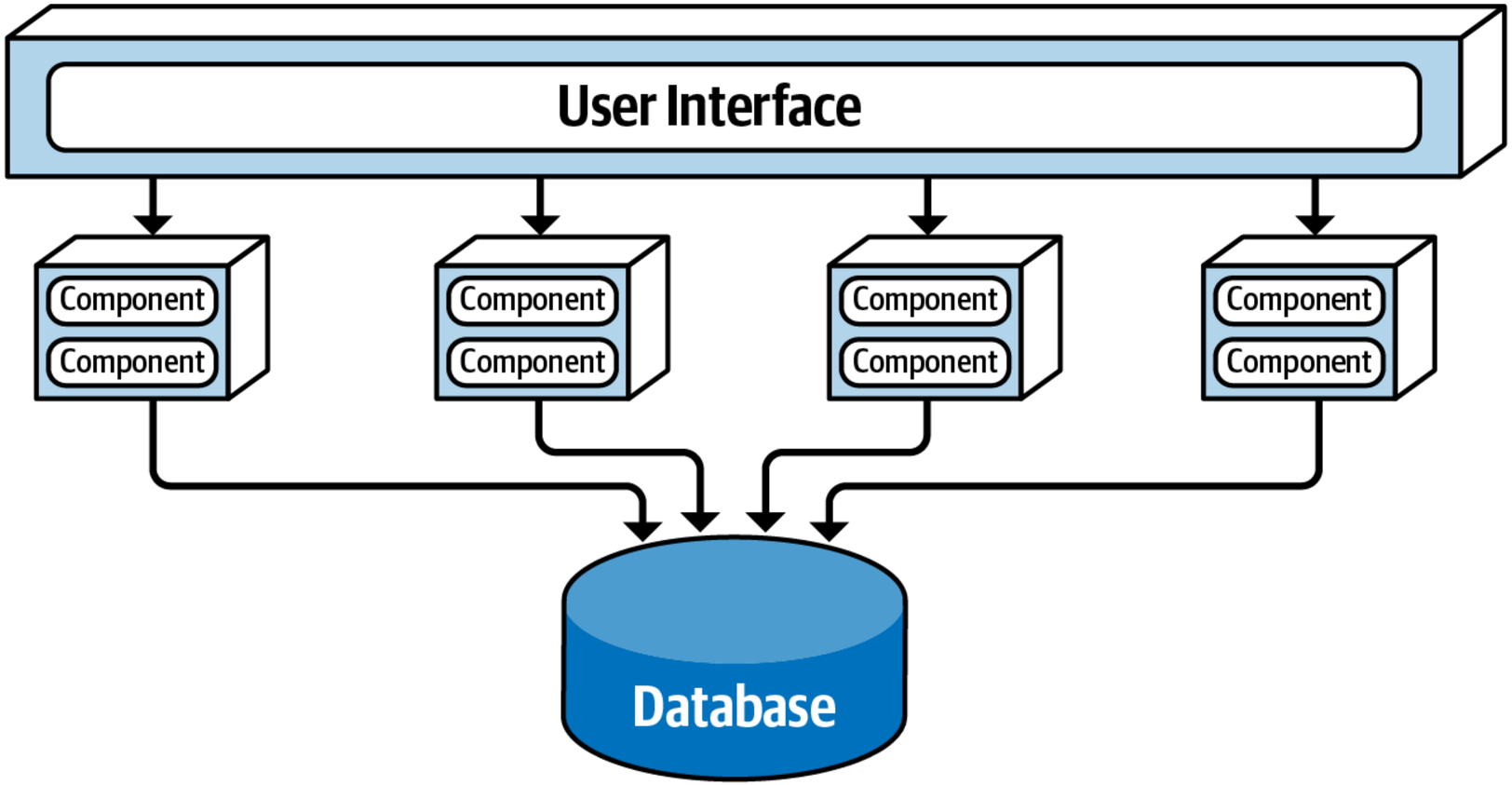
monolith => service-based





common migration target

suitability: service-based ?



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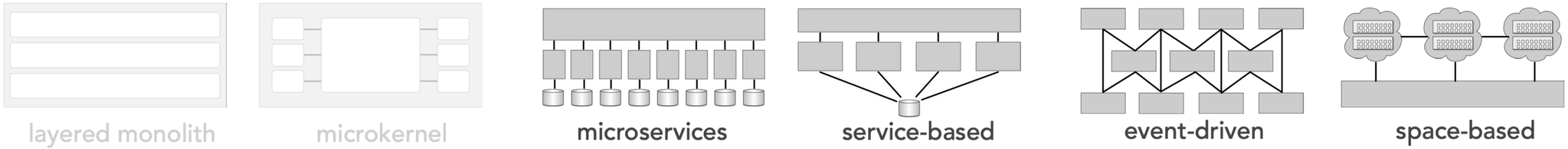
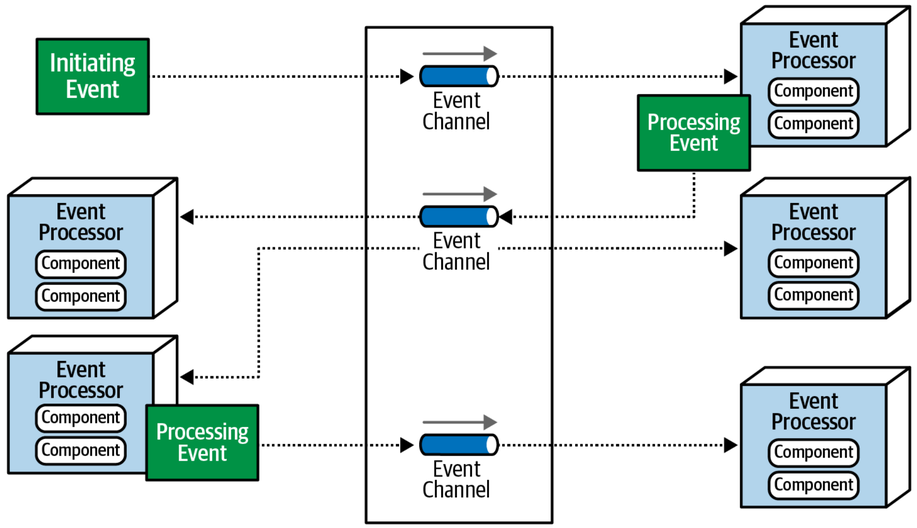
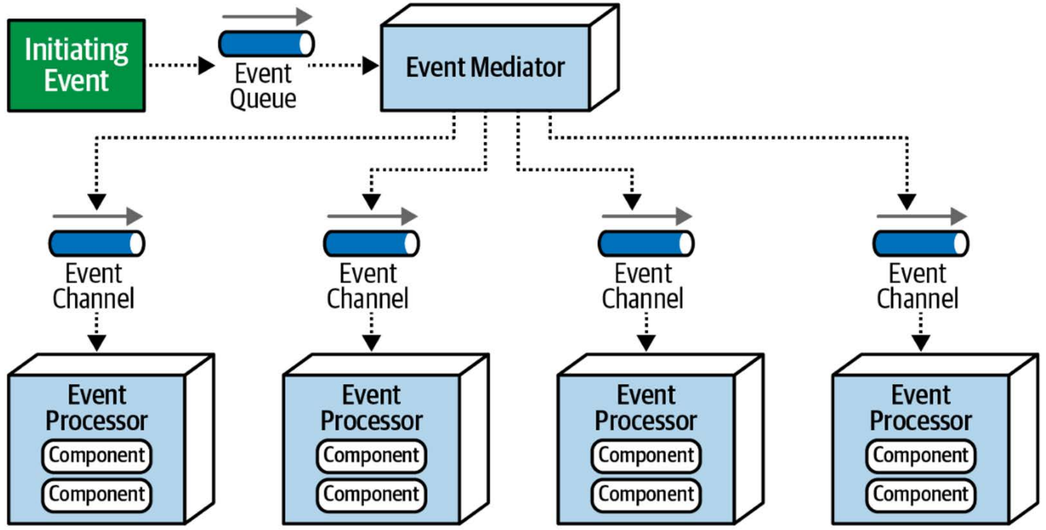


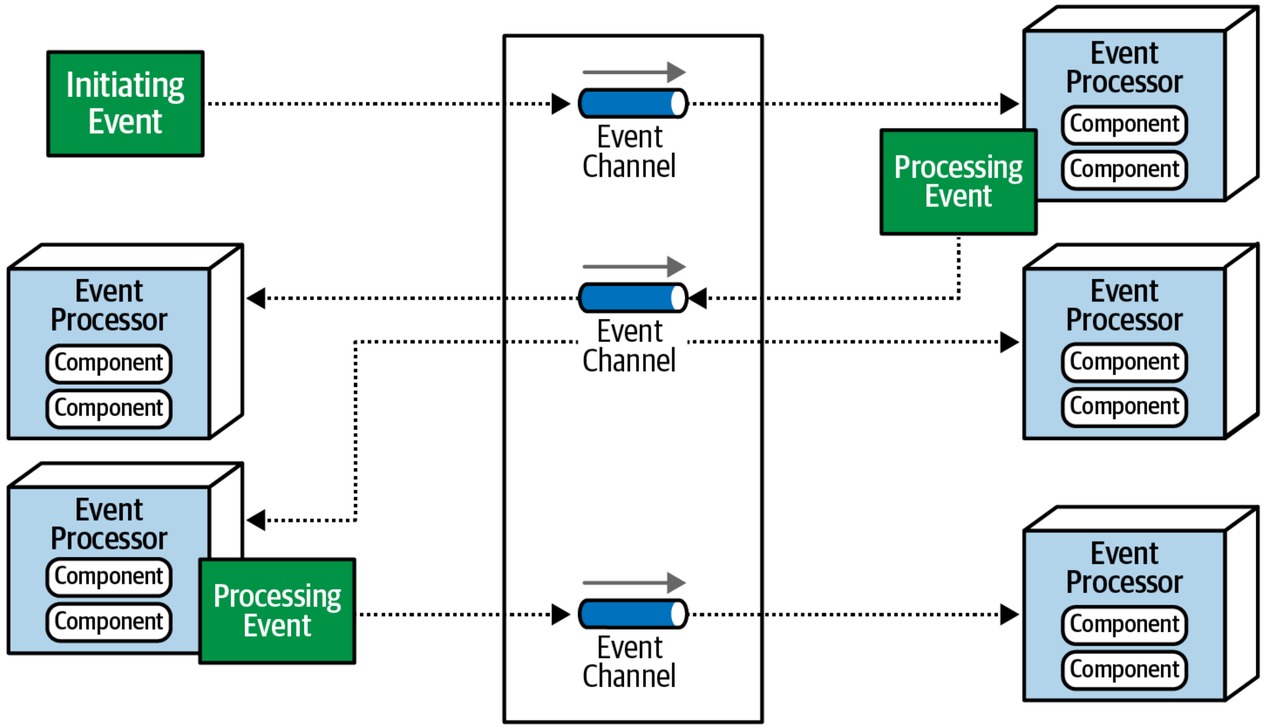
	layered monolith	microkernel	microservices	service-based	event-driven	space-based
agility	★	★★★	★★★★★	★★★★	★★★★	★★★
deployment	★	★★★	★★★★★	★★★★	★★★	★★★
testability	★★	★★★	★★★★★	★★★★	★★	★
performance	★★★	★★★	★★	★★★	★★★★★	★★★★★
scalability	★	★	★★★★★	★★★	★★★★	★★★★★
elasticity	★	★	★★★★	★★	★★★	★★★★★
simplicity	★★★★★	★★★★	★	★★★	★	★
fault-tolerance	★	★	★★★★★	★★★★	★★★★★	★★★
evolvability	★	★★★	★★★★★	★★★★	★★★★★	★★★
total cost	★★★★★	★★★★★	★	★★★★	★★★	★★

event-driven architecture

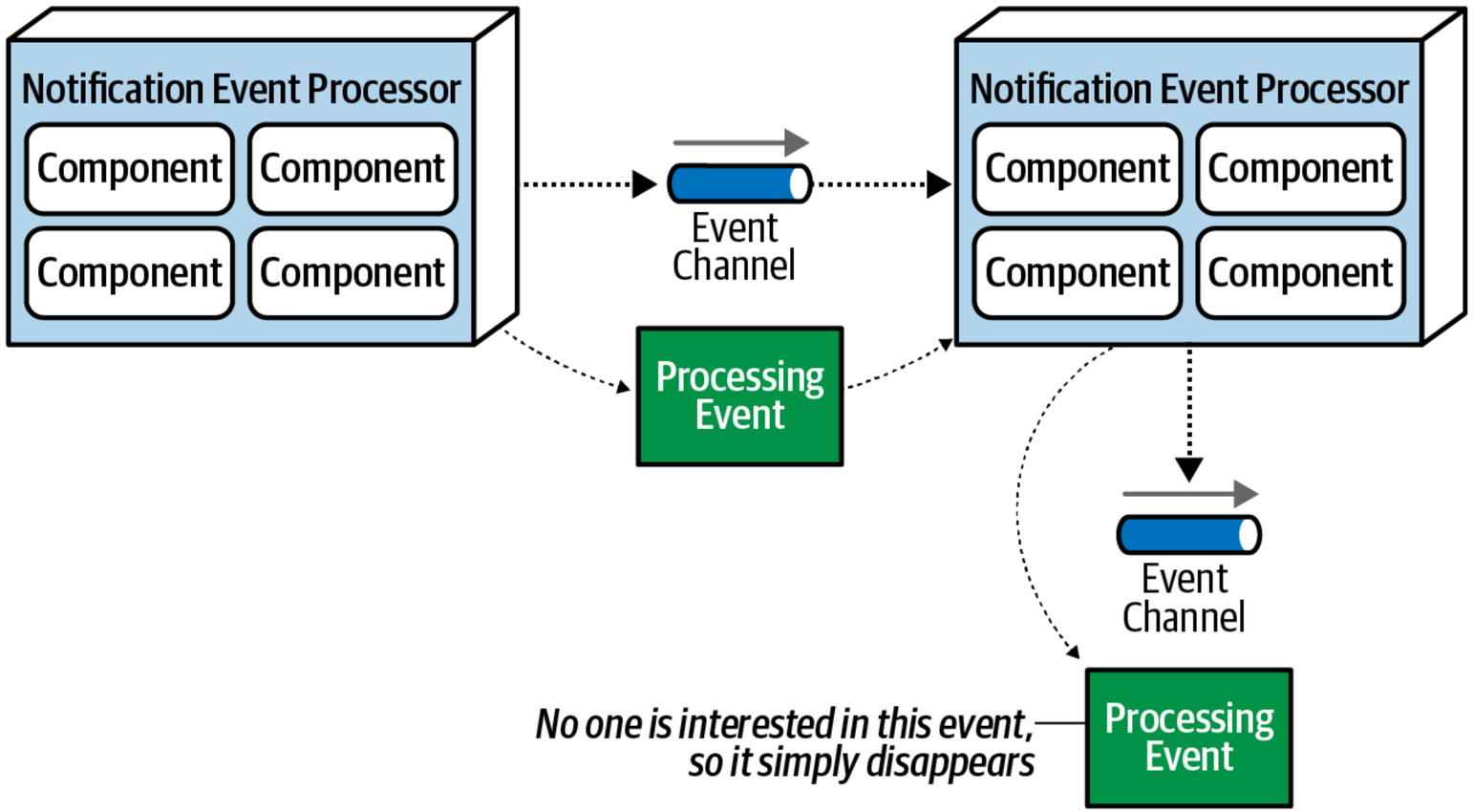




EDA: broker


Initiating Event
Event Channel
Event Channel
Event Channel
Processing Event
Processing Event
Event Processor
Component
Component
Event Processor
Component
Component
Event Processor
Component
Component
Event Processor
Component
Component
Event Processor
Component
Component

event-driven architecture



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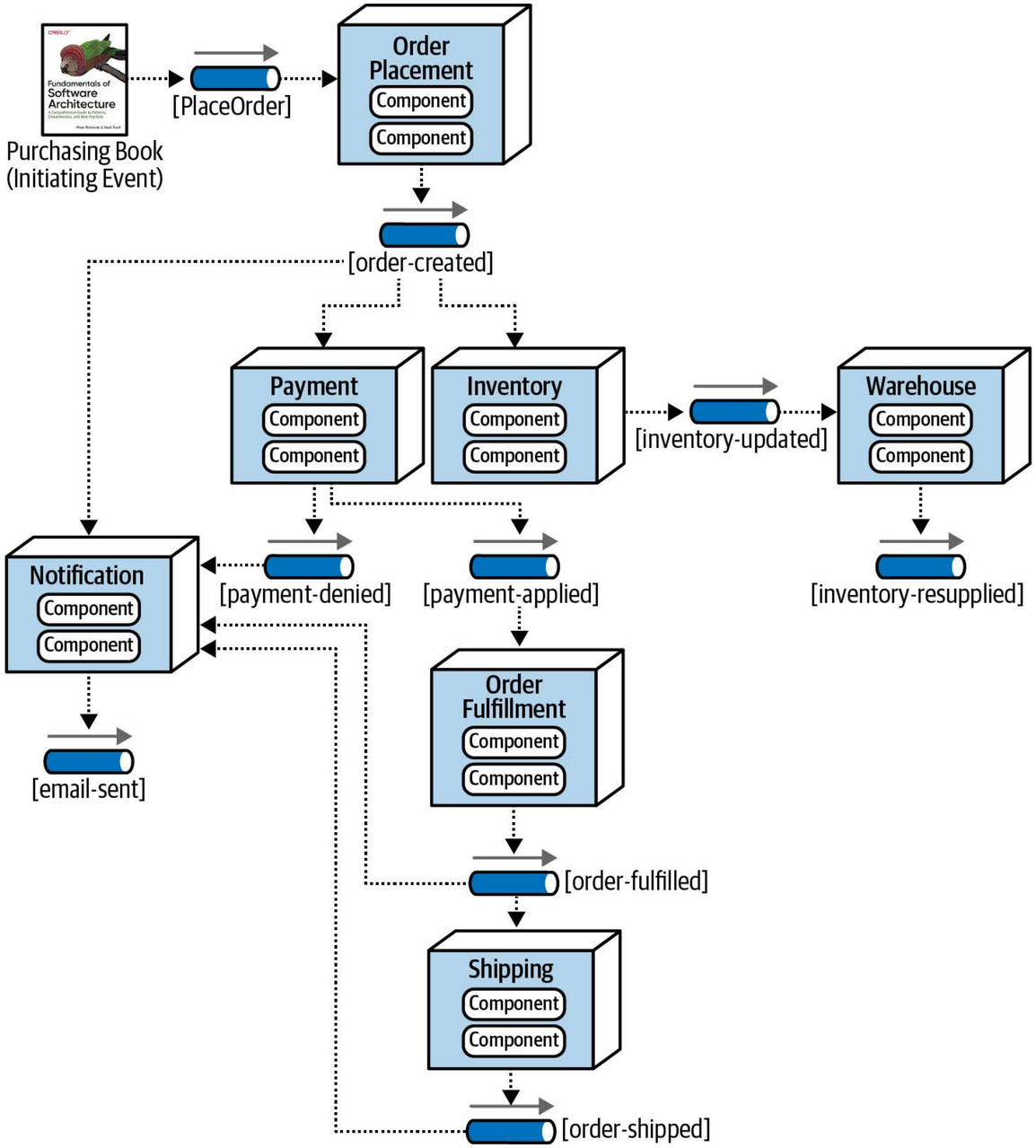
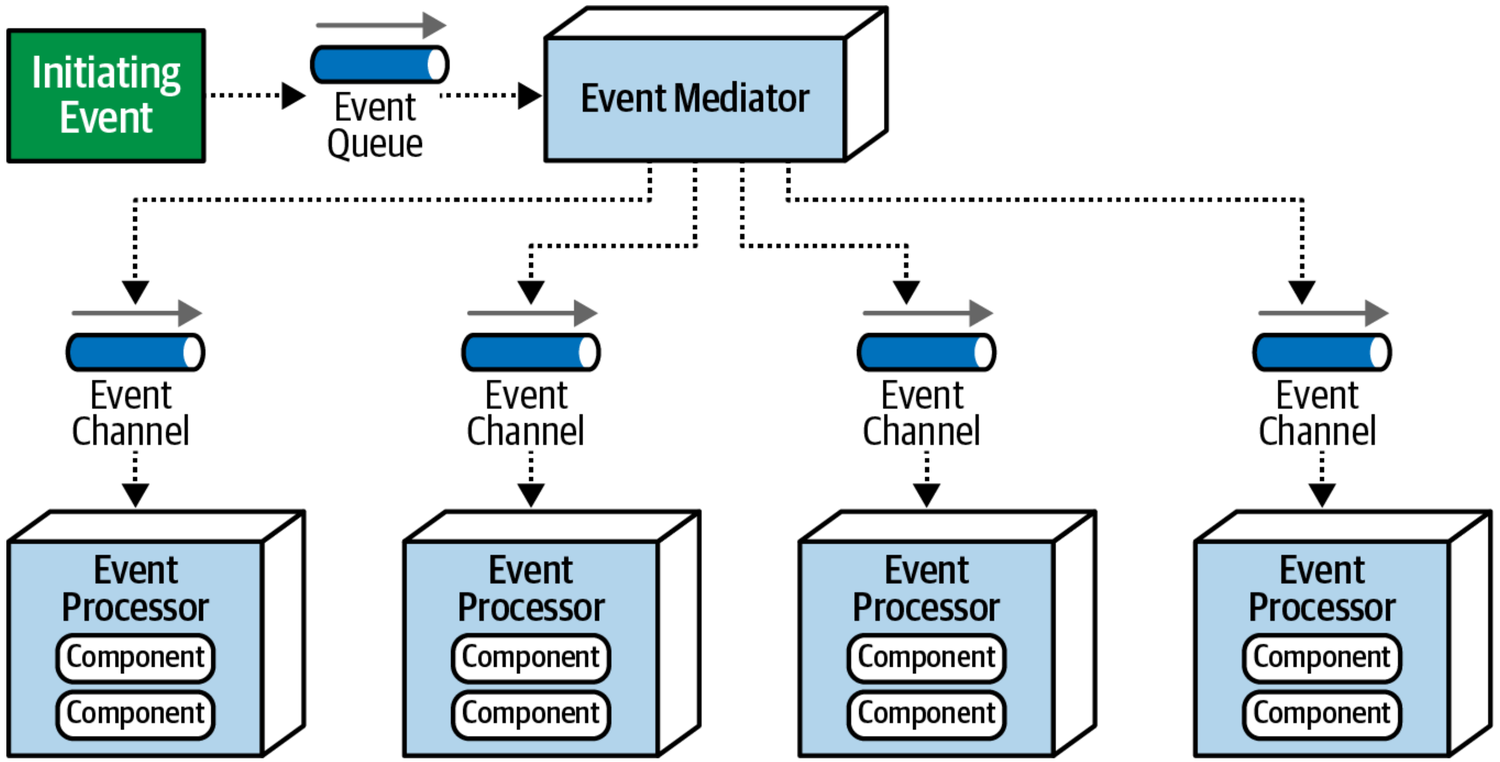

Fundamentals of Software Architecture
Purchasing Book
(Initiating Event)
[PlaceOrder]
Order Placement
Component
Component
[order-created]
Payment
Component
Component
Inventory
Component
Component
[inventory-updated]
Warehouse
Component
Component
[inventory-resupplied]
Notification
Component
Component
[payment-denied]
[payment-applied]
[email-sent]
Order Fulfillment
Component
Component
[order-fulfilled]
Shipping
Component
Component
[order-shipped]

EDA: mediator



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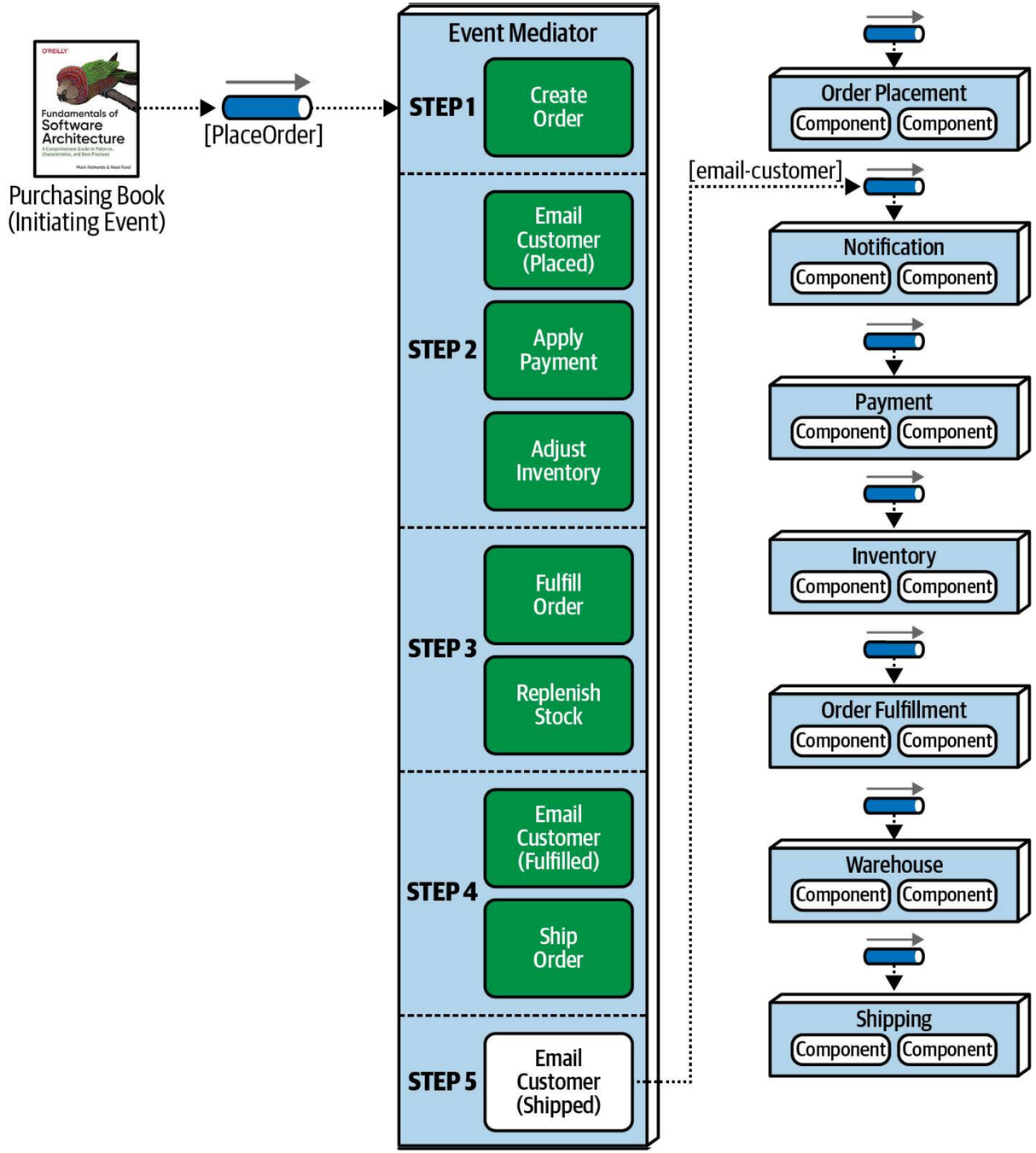
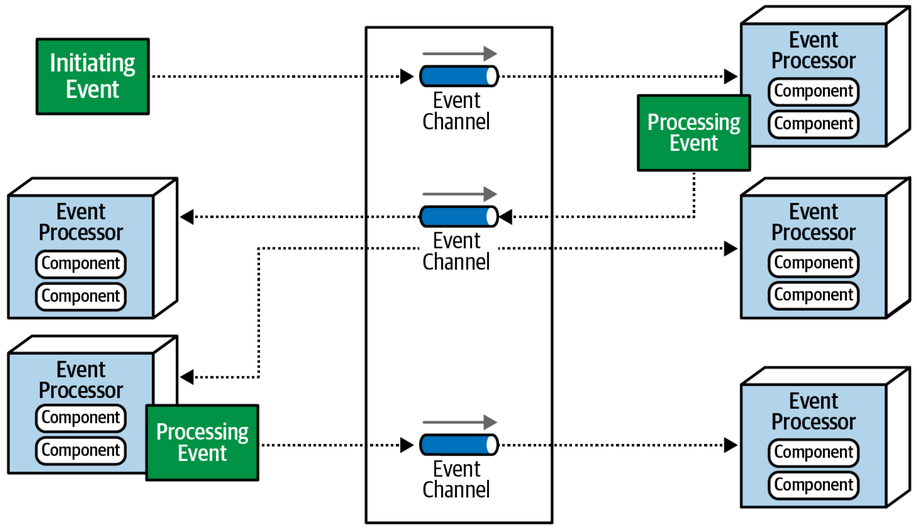
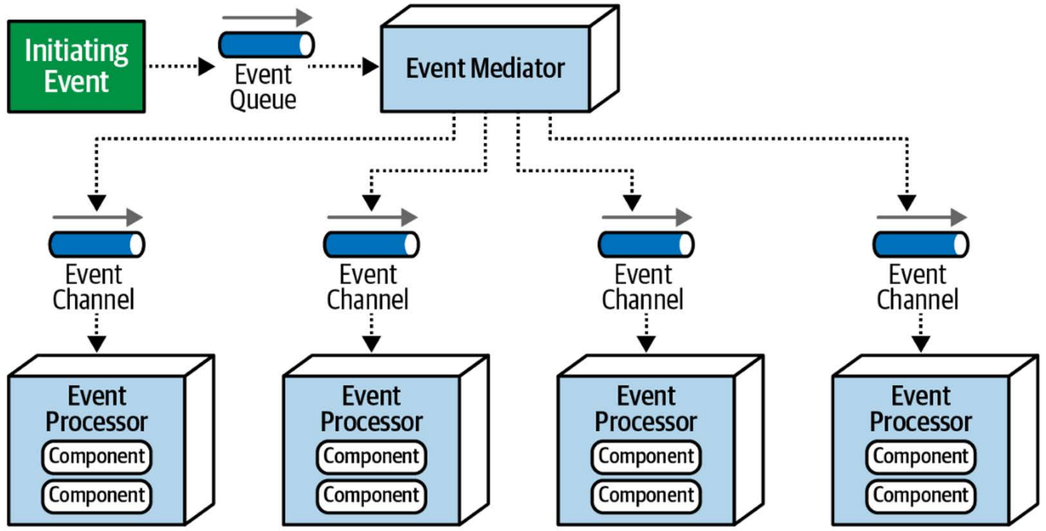


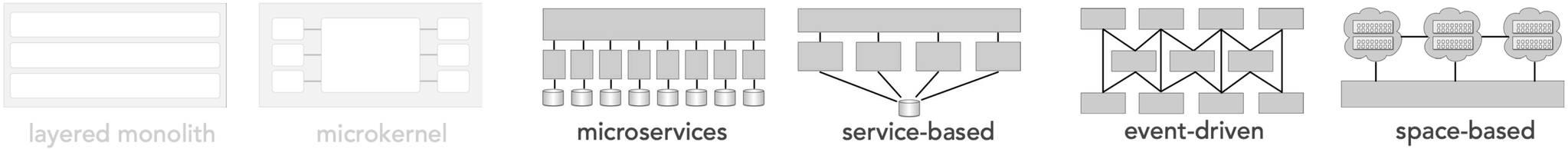
suitability: EDA ?





Your Architectural Kata is...

Going Going Gone!



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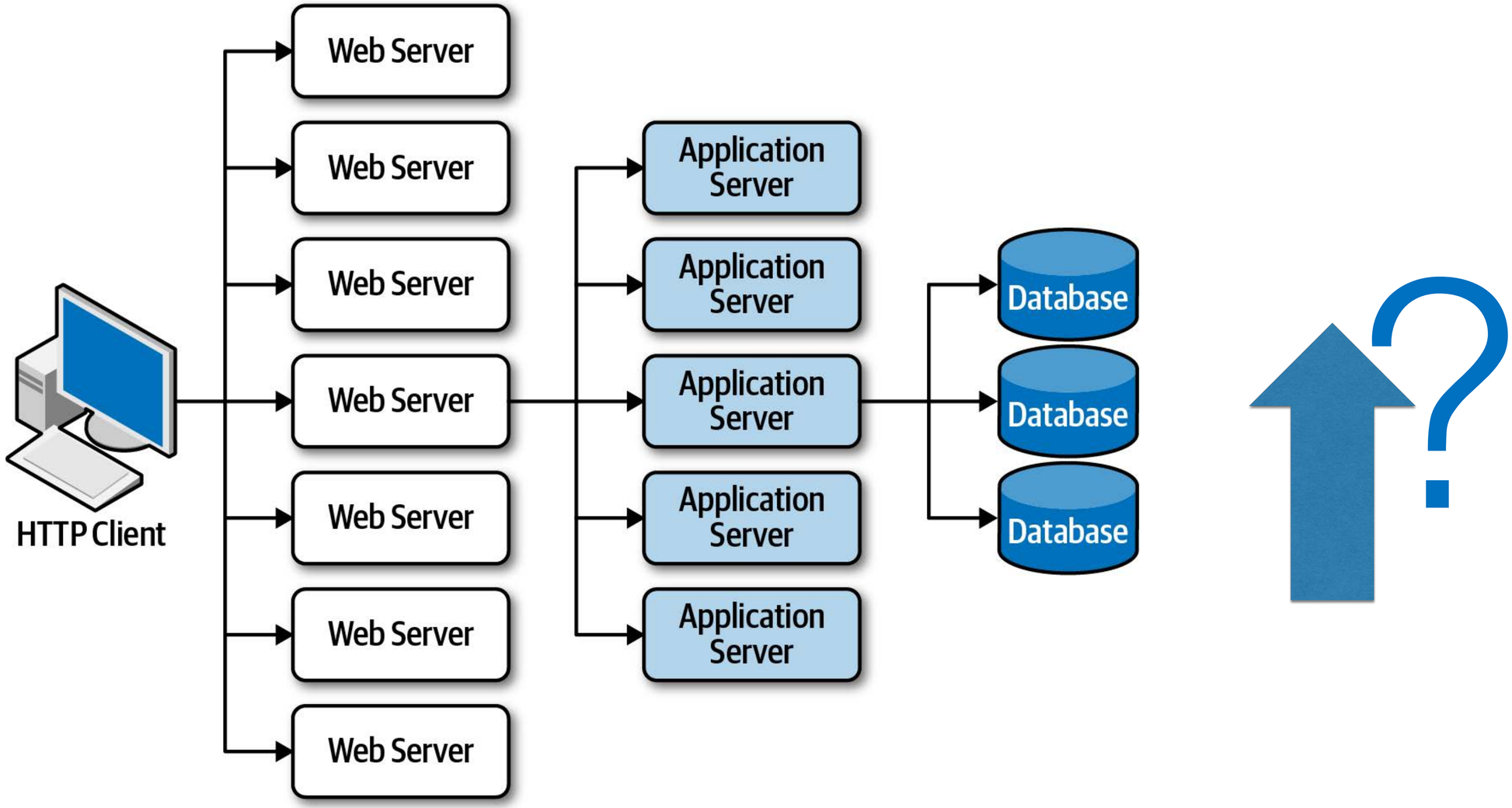
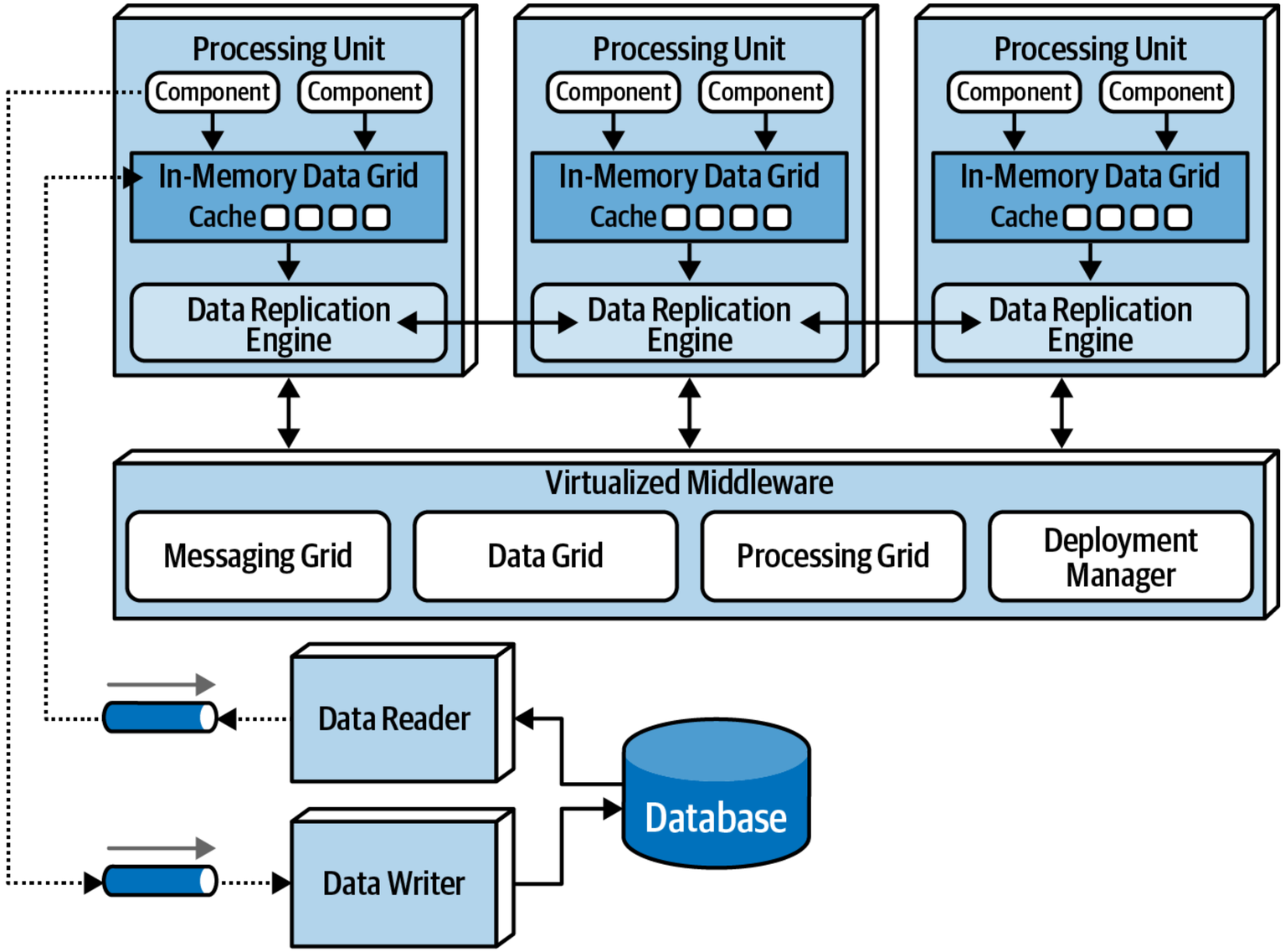
agility	★	★★★	★★★★★	★★★★	★★★★	★★★
deployment	★	★★★	★★★★★	★★★★	★★★	★★★
testability	★★	★★★	★★★★★	★★★★	★★	★
performance	★★★	★★★	★★	★★★	★★★★★	★★★★★
scalability	★	★	★★★★★	★★★	★★★★	★★★★★
elasticity	★	★	★★★★	★★	★★★	★★★★★
simplicity	★★★★★	★★★★	★	★★★	★	★
fault-tolerance	★	★	★★★★★	★★★★	★★★★★	★★★
evolvability	★	★★★	★★★★★	★★★★	★★★★★	★★★
total cost	★★★★★	★★★★★	★	★★★★	★★★	★★

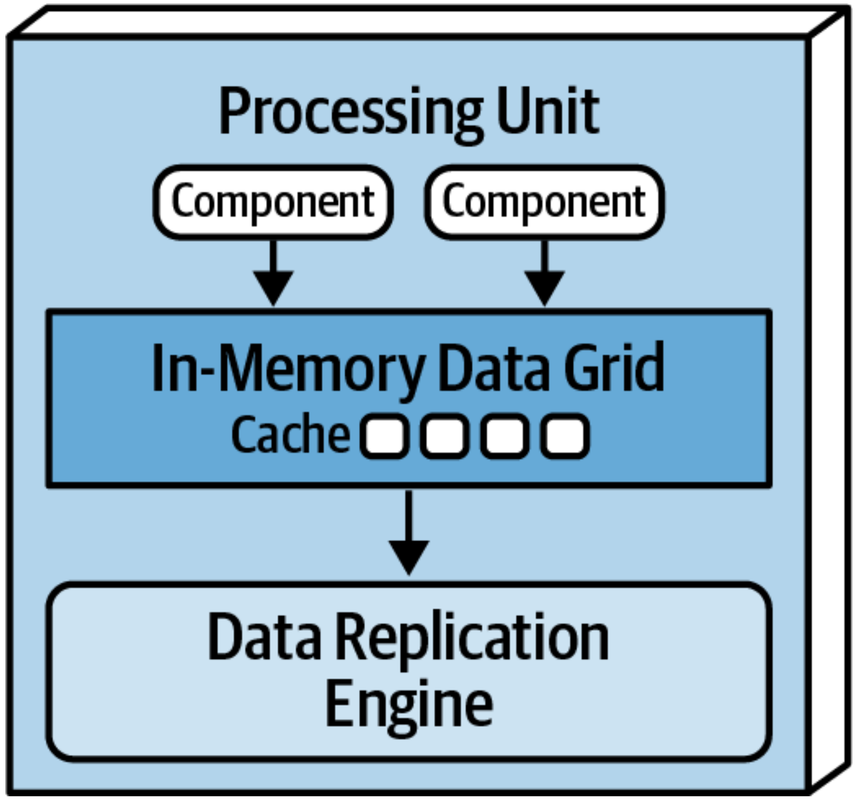
space-based architecture



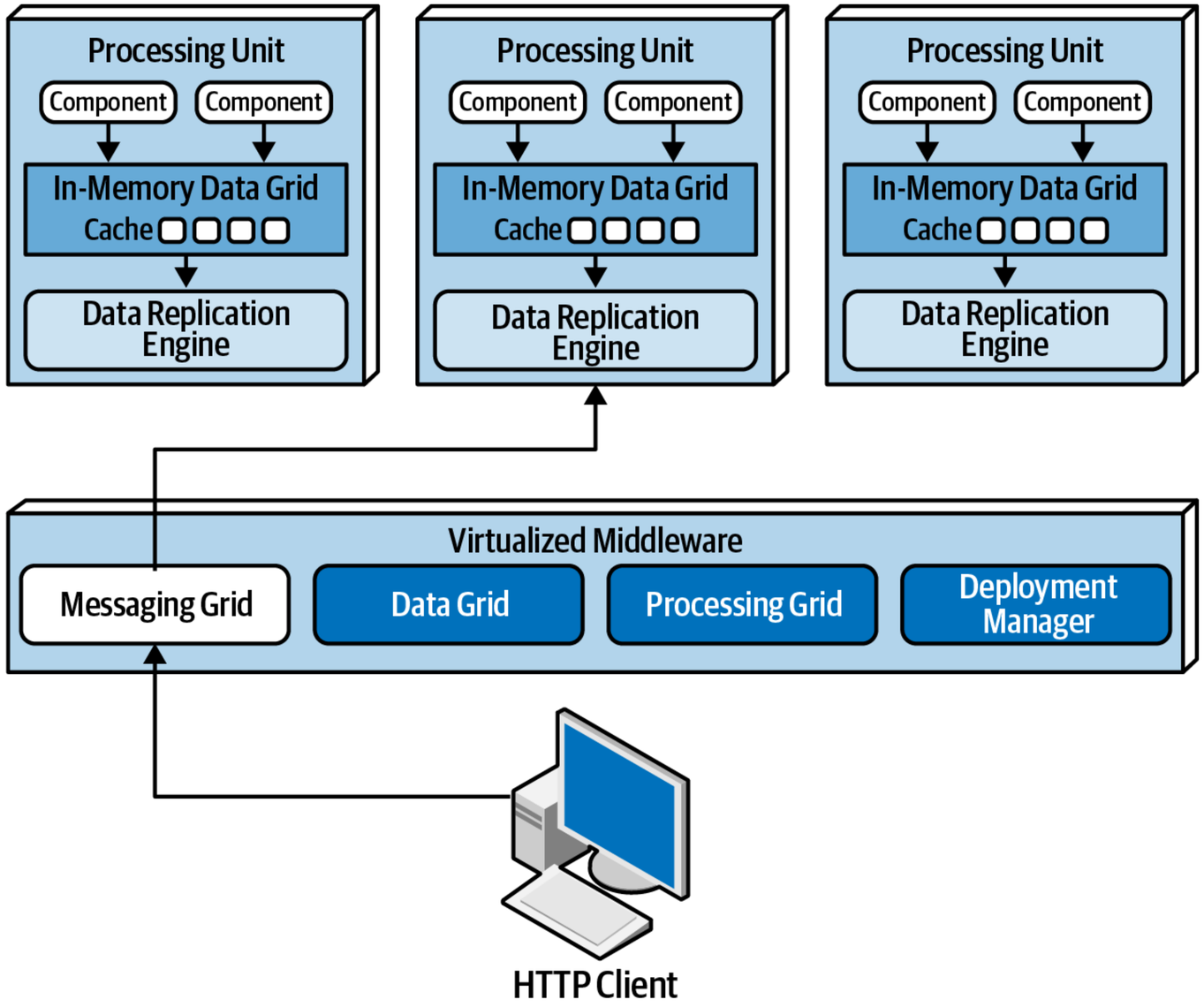
space-based architecture



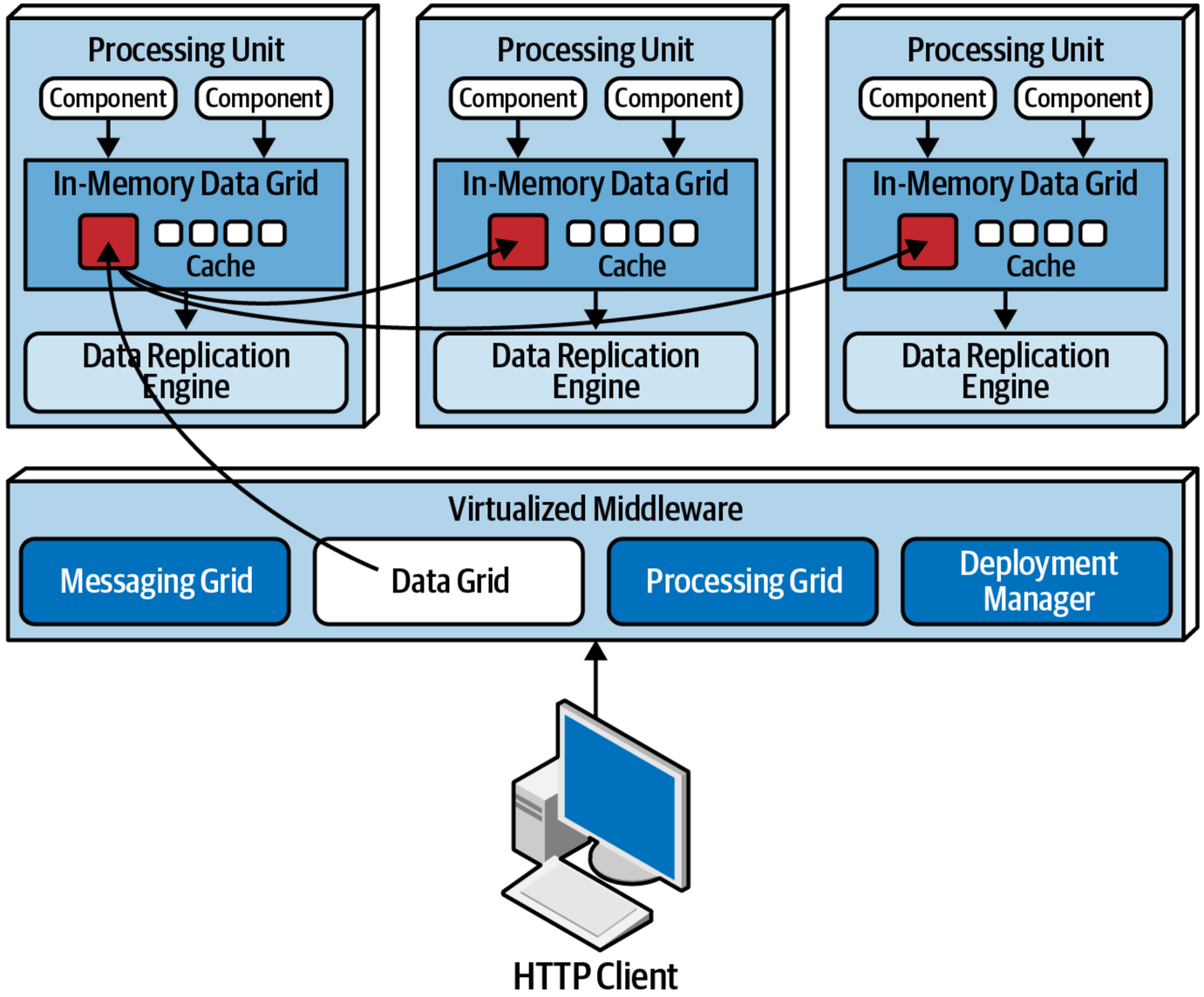
space-based architecture



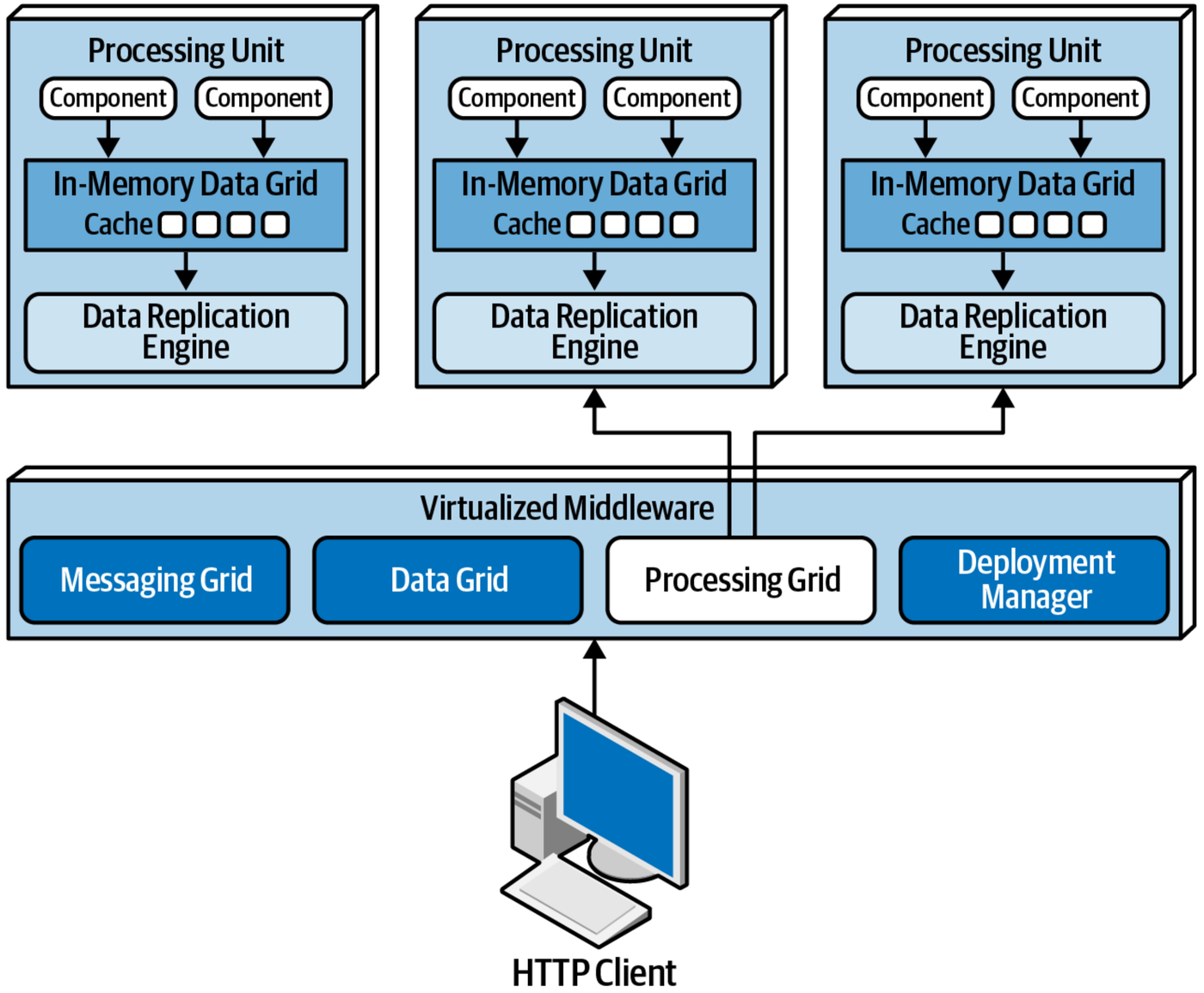
space-based architecture



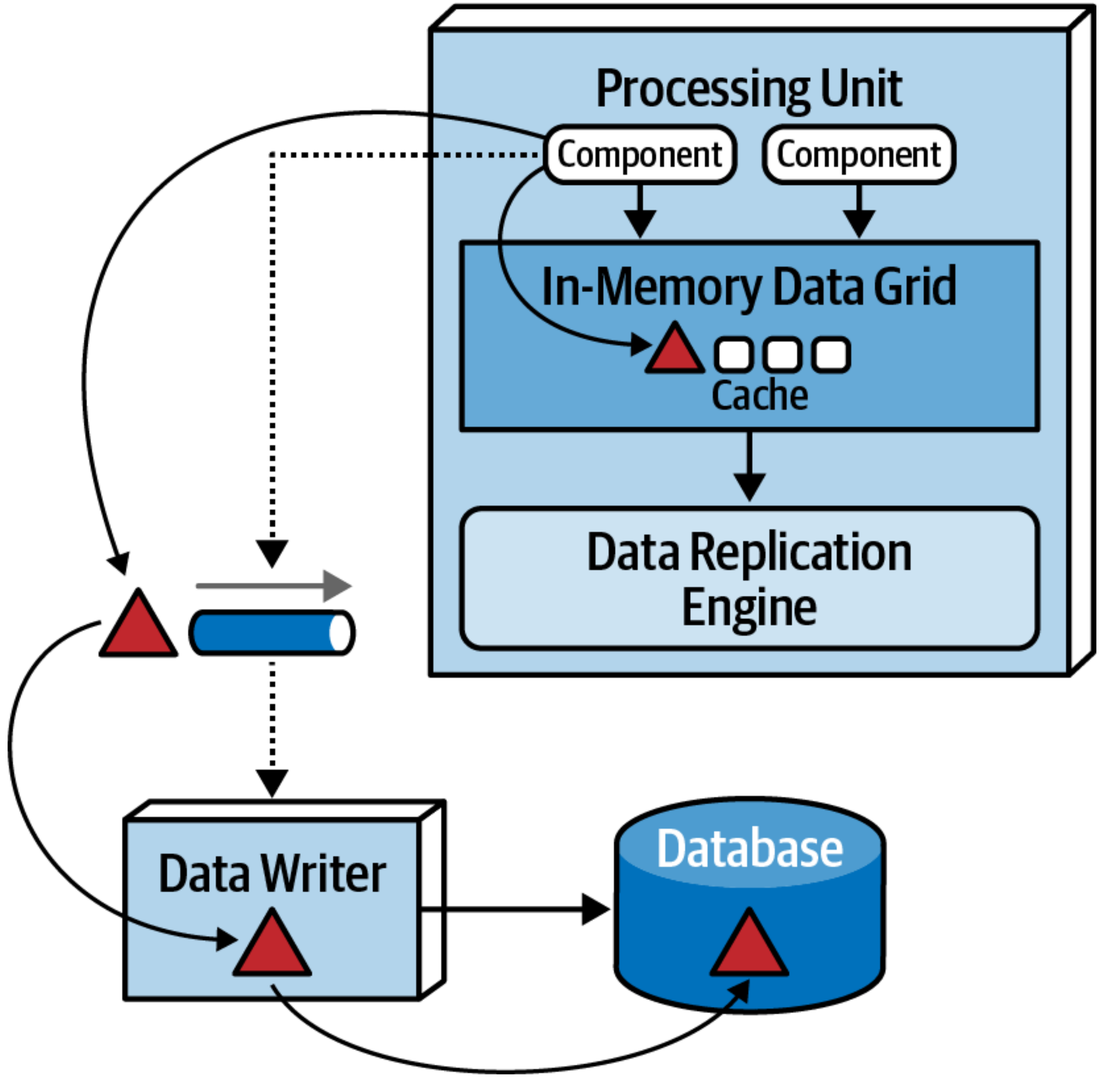
space-based architecture



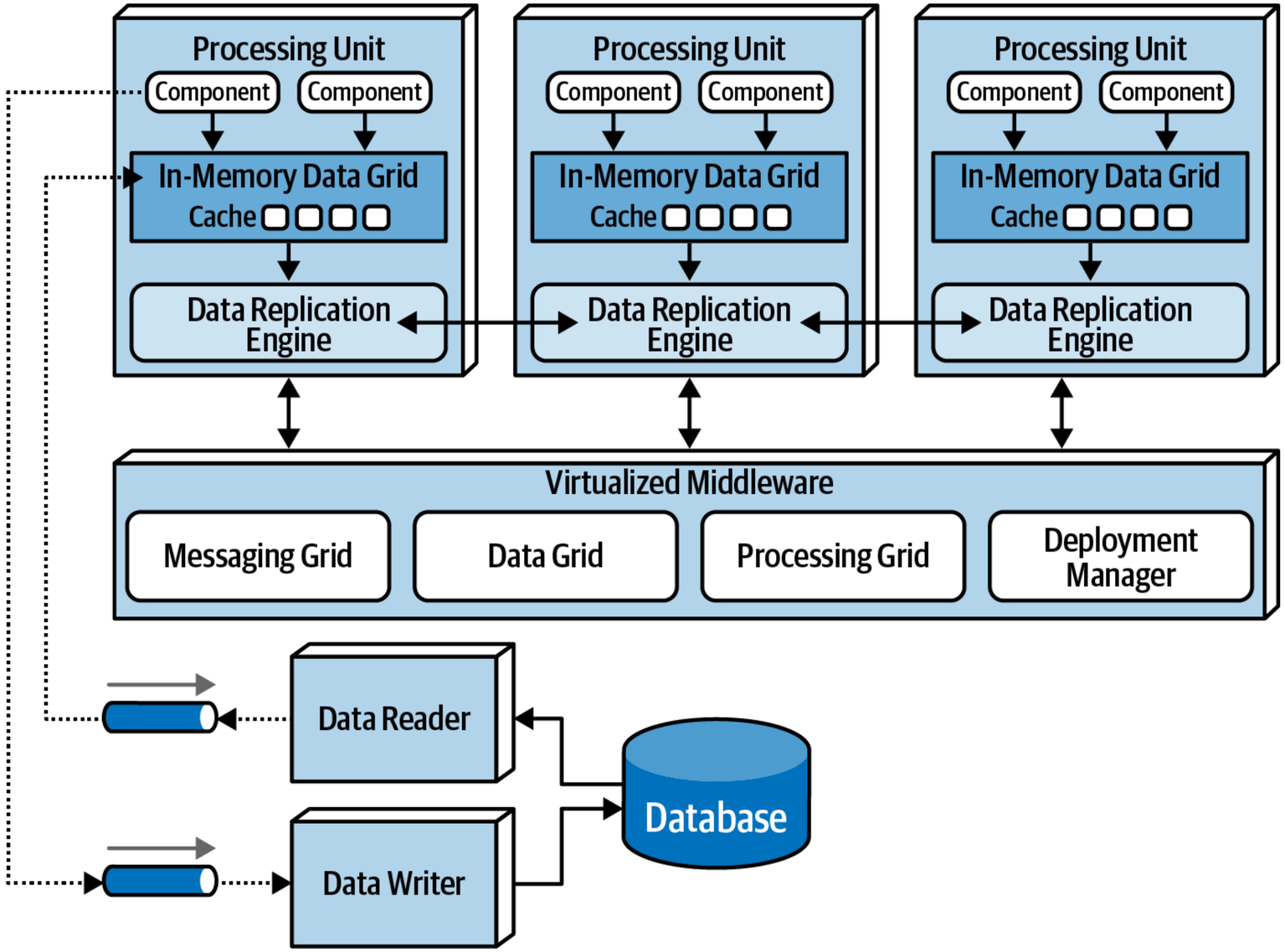
space-based architecture



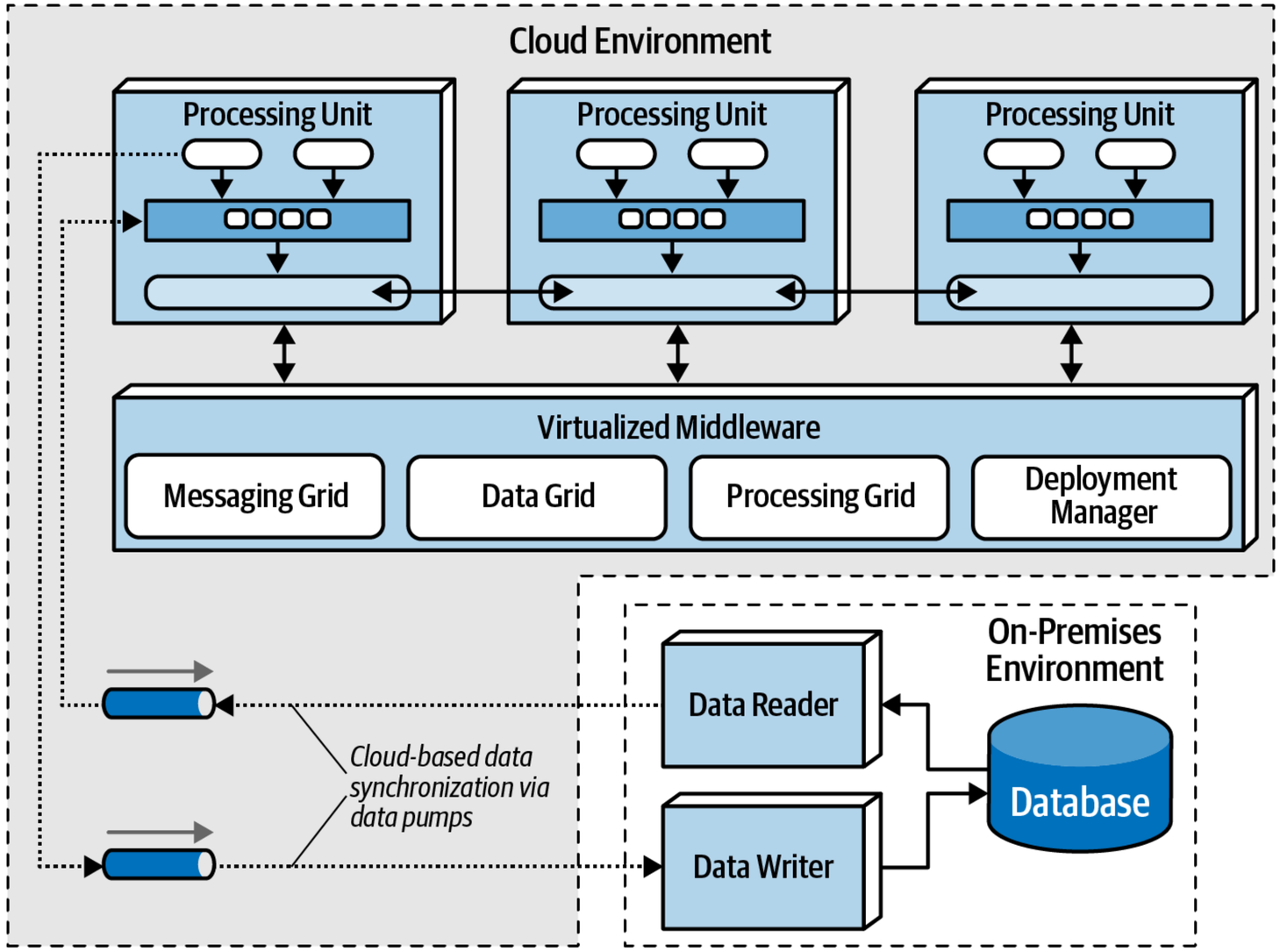
space-based architecture



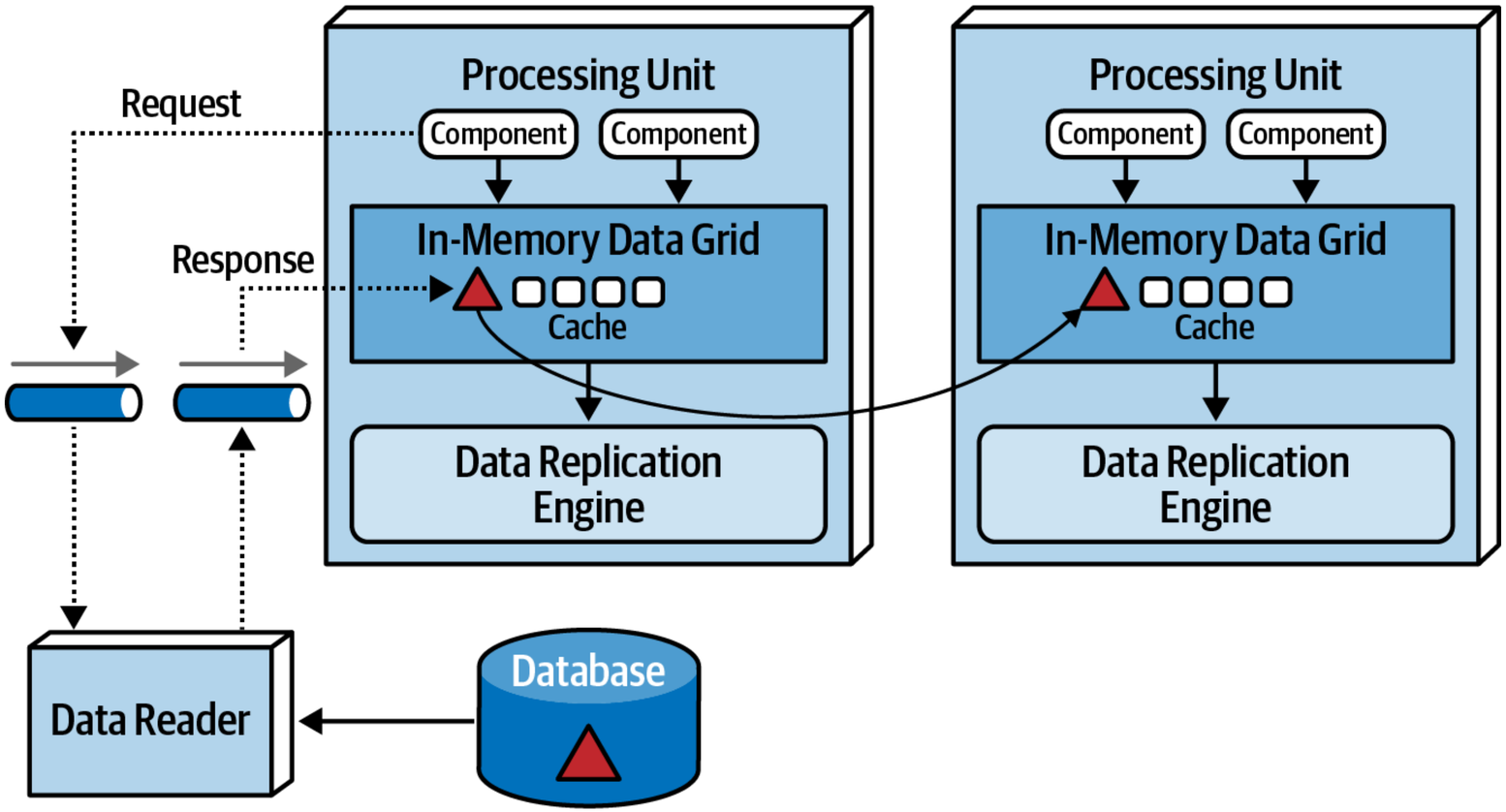
space-based architecture



space-based architecture

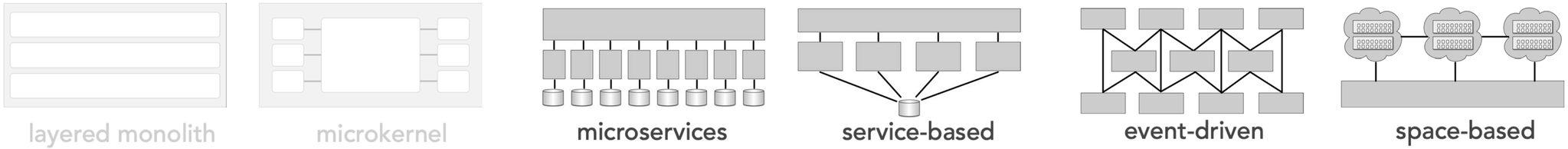


suitability: space-based ?



Your Architectural Kata is...

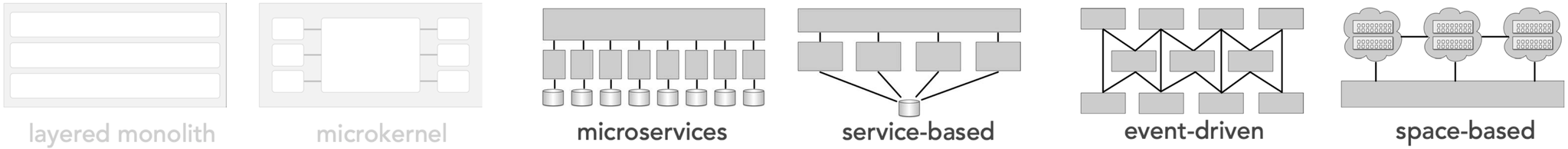
Going Going Gone!



	layered monolith	microkernel	microservices	service-based	event-driven	space-based
agility	★	★★★	★★★★★	★★★★	★★★★	★★★
deployment	★	★★★	★★★★★	★★★★	★★★	★★★
testability	★★	★★★	★★★★★	★★★★	★★	★
performance	★★★	★★★	★★	★★★	★★★★★	★★★★★
scalability	★	★	★★★★★	★★★	★★★★	★★★★★
elasticity	★	★	★★★★	★★	★★★	★★★★★
simplicity	★★★★★	★★★★	★	★★★	★	★
fault-tolerance	★	★	★★★★★	★★★★	★★★★★	★★★
evolvability	★	★★★	★★★★★	★★★★	★★★★★	★★★
total cost	★★★★★	★★★★★	★	★★★★	★★★	★★

Your Architectural Kata is...

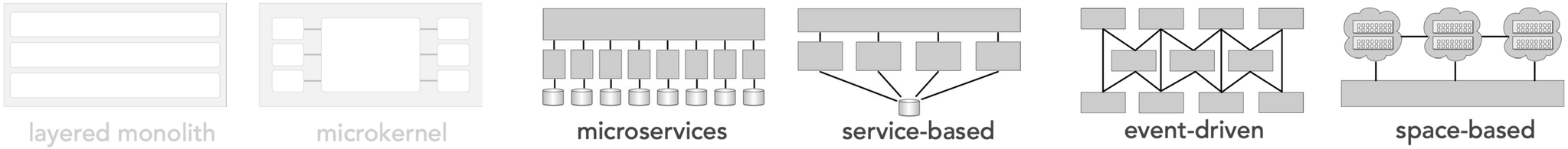
Going Going Gone!



	layered monolith	microkernel	microservices	service-based	event-driven	space-based
agility	★	★★★	★★★★★	★★★★	★★★★	★★★
deployment	★	★★★	★★★★★	★★★★	★★★	★★★
testability	★★	★★★	★★★★★	★★★★	★★	★
performance	★★★	★★★	★★	★★	★★★★★	★★★★★
scalability	★	★	★★★★★	★★★	★★★★	★★★★★
elasticity	★	★	★★★★	★★	★★★	★★★★★
simplicity	★★★★★	★★★★	★	★★★★	★	★
fault-tolerance	★	★	★★★★★	★★★★	★★★★★	★★★
evolvability	★	★★★	★★★★★	★★★★	★★★★★	★★★
total cost	★★★★★	★★★★★	★	★★★★	★★★	★★

Your Architectural Kata is...

Going Going Gone!



	layered monolith	microkernel	microservices	service-based	event-driven	space-based
agility	★	★★★	★★★★★	★★★★	★★★★	★★★
deployment	★	★★★	★★★★★	★★★★	★★★	★★★
testability	★★	★★★	★★★★★	★★★★	★★	★
performance	★★★	★★★	★★	★★★	★★★★★	★★★★
scalability	★	★	★★★★★	★★★★	★★★★	★★★★★
elasticity	★	★	★★★★	★★★	★★★	★★★★
simplicity	★★★★★	★★★★	★	★★★	★	
fault-tolerance	★	★	★★★★★	★★★★	★★★★★	★★★
evolvability	★	★★★	★★★★★	★★★★	★★★★★	★★★
total cost	★★★★★	★★★★★	★	★★★★	★★★	★★

Your Architectural Kata is...

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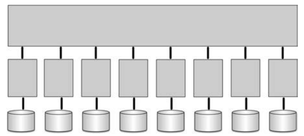
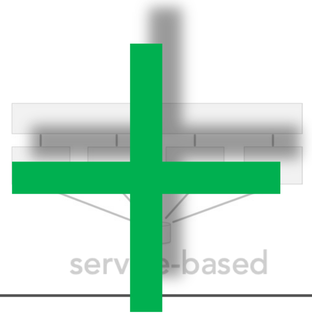
layered monolith

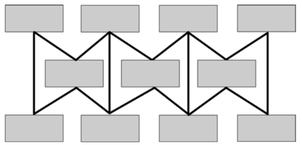
microkernel



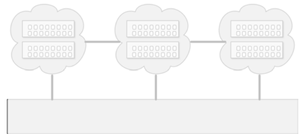
microservices



serv e-based



event-driven

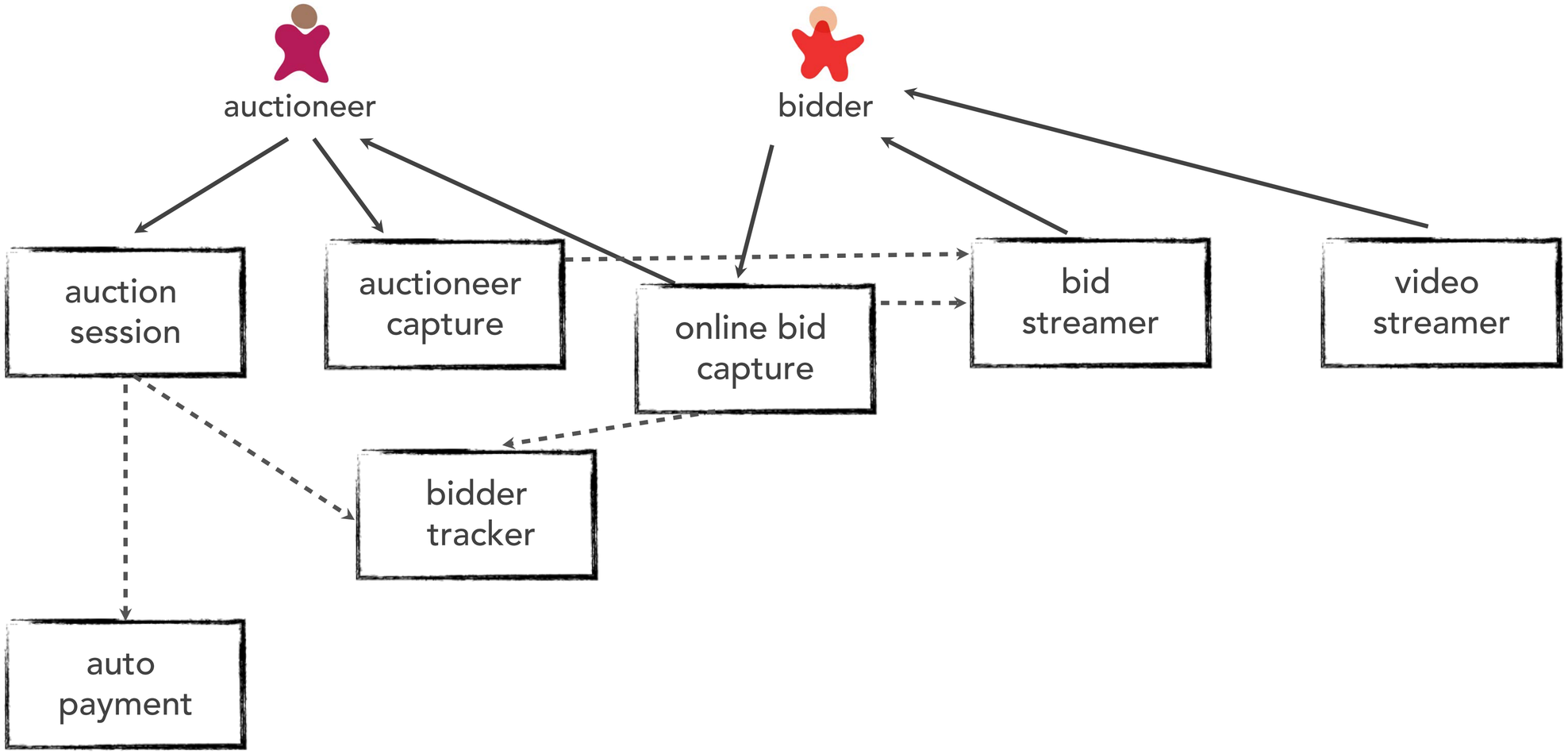


space-based

agility	★	★★★	★★★★★	★★★★	★★★★	★★★
deployment	★	★★★	★★★★★	★★★★	★★★	★★★
testability	★★	★★★	★★★★★	★★★★	★★	★
performance	★★★	★★★	★★	★★★	★★★★★	★★★★★
scalability	★	★	★★★★★	★★★	★★★★	★★★★★
elasticity	★	★	★★★★	★★	★★★	★★★★★
simplicity	★★★★★	★★★★	★	★★★	★	★
fault-tolerance	★	★	★★★★★	★★★★	★★★★★	★★★
evolvability	★	★★★	★★★★★	★★★★	★★★★★	★★★
total cost	★★★★★	★★★★★	★	★★★★	★★★	★★

Your Architectural Kata is...

Going Going Gone!



Your Architectural Kata is...

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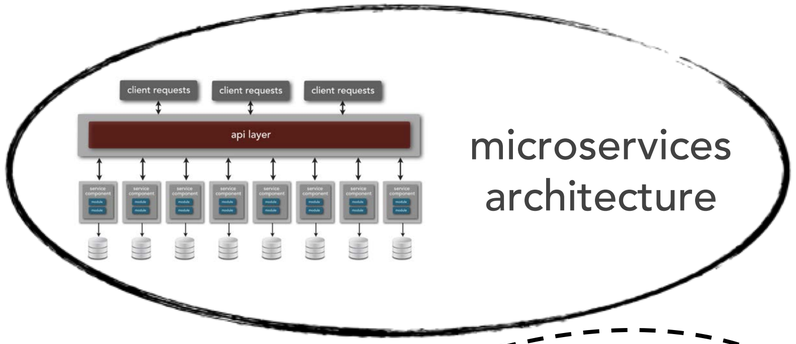
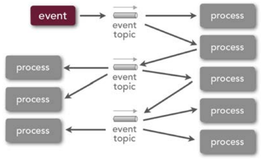
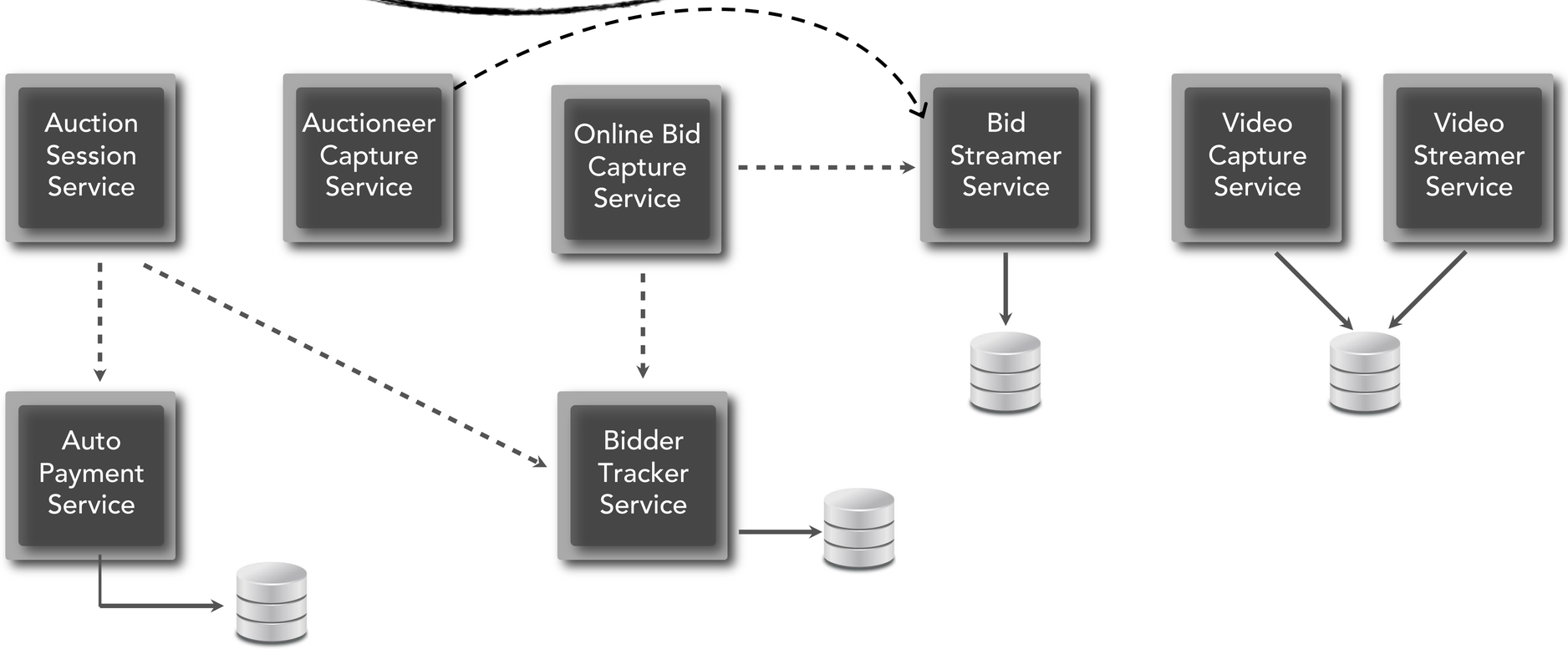


microservices architecture

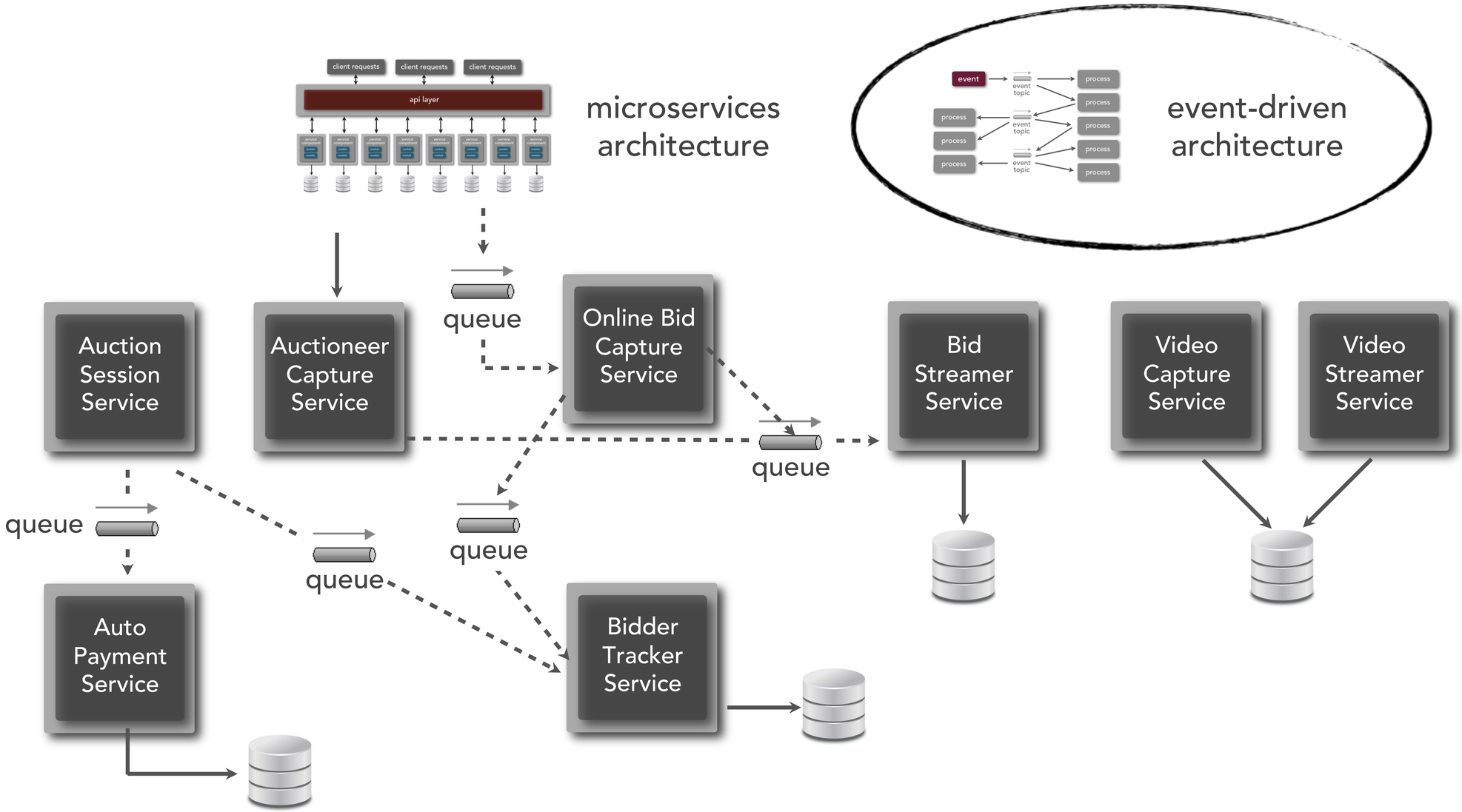


event-driven architecture



Your Architectural Kata is...

Going Going Gone!



Your Architectural Kata is...

Silicon Sandwiches

A national sandwich shop wants to enable 'fax in your order' but over the Internet instead (in addition to their current fax-in service)

- ***Users:*** thousands, perhaps one day millions
- ***Requirements:***
  - users will place their order, then be given a time to pick up their sandwich and directions to the shop (which must integrate with several external mapping services that include traffic information)
  - if the shop offers a delivery service, dispatch the driver with the sandwich to the user
  - mobile-device accessibility
  - offer national daily promotions/specials
  - offer local daily promotions/specials
  - accept payment online or in person/on delivery
- ***Additional Context:***
  - Sandwich shops are franchised, each with a different owner.
  - Parent company has near-future plans to expand overseas.
  - Corporate goal is to hire inexpensive labor to maximize profit.
  - Time to market is critical.

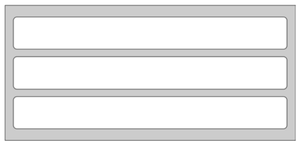
availability reliability

scalability

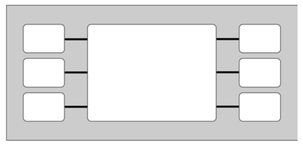
customizability { location, sales, recipe

Your Architectural Kata is...

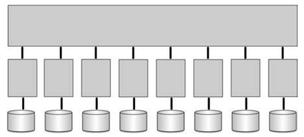
Silicon Sandwiches



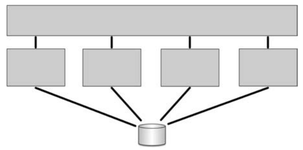
layered monolith



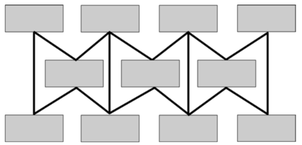
microkernel



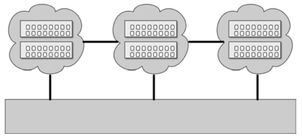
microservices



service-based



event-driven

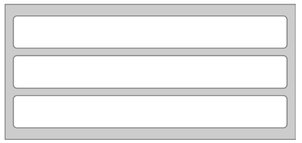
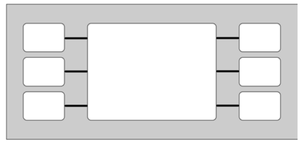
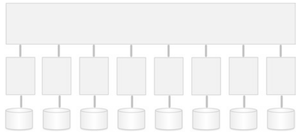
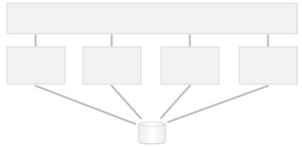
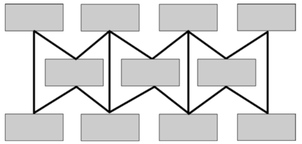
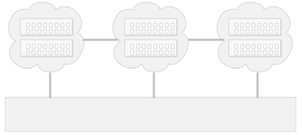


space-based

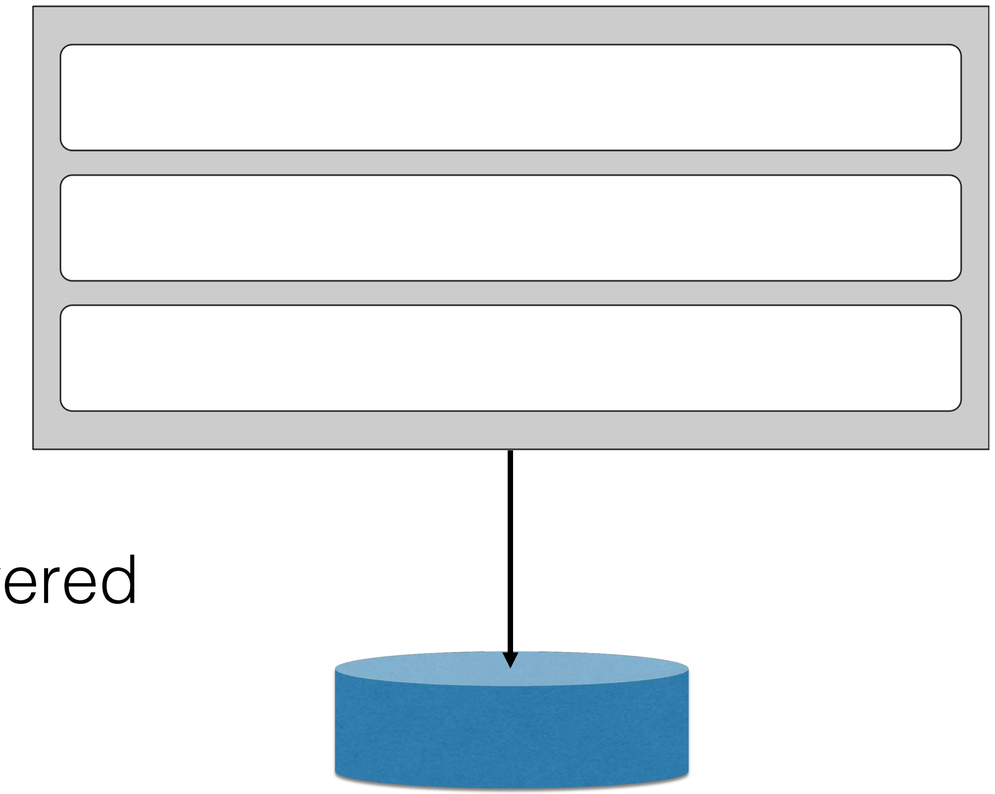
	layered monolith	microkernel	microservices	service-based	event-driven	space-based
agility	★	★★★	★★★★★	★★★★	★★★★	★★★
deployment	★	★★★	★★★★★	★★★★	★★★	★★★
testability	★★	★★★	★★★★★	★★★★	★★	★
performance	★★★	★★★	★★	★★★	★★★★★	★★★★★
scalability	★	★	★★★★★	★★★	★★★★	★★★★★
elasticity	★	★	★★★★	★★	★★★	★★★★★
simplicity	★★★★★	★★★★	★	★★★	★	★
fault-tolerance	★	★	★★★★★	★★★★	★★★★★	★★★
evolvability	★	★★★	★★★★★	★★★★	★★★★★	★★★
total cost	★★★★★	★★★★★	★	★★★★	★★★	★★

Your Architectural Kata is...

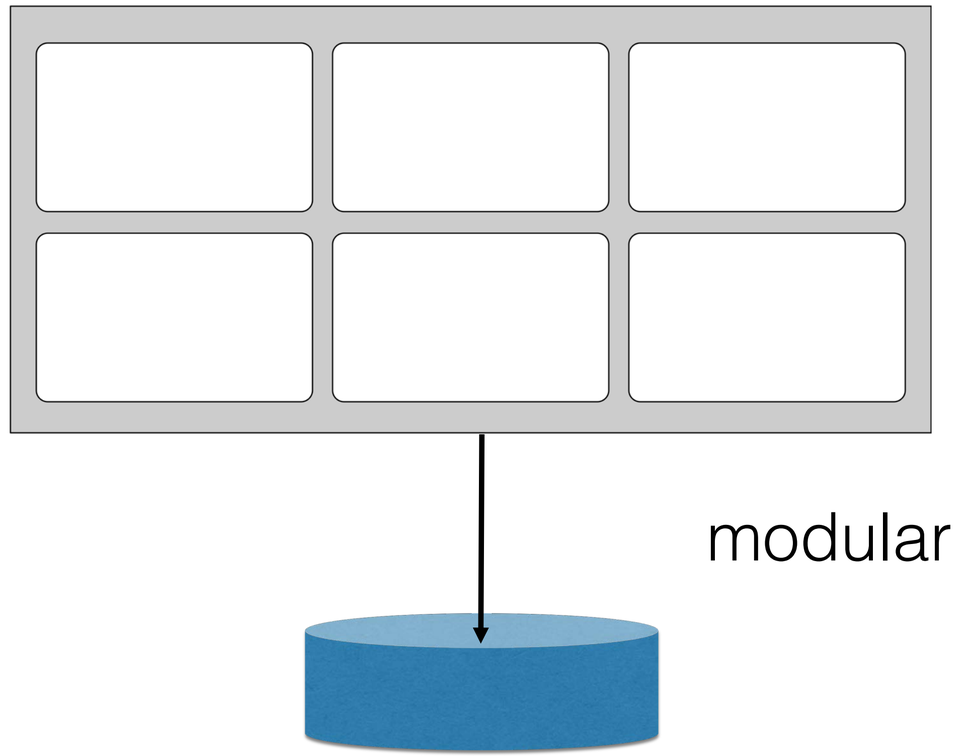
Silicon Sandwiches

	 layered monolith	 microkernel	 microservices	 service-based	 event-driven	 space-based
agility	★	★★★	★★★★★	★★★★	★★★★	★★★
deployment	★	★★★	★★★★★	★★★★	★★★	★★★
testability	★★	★★★	★★★★★	★★★★	★★	★
performance	★★★	★★★	★★	★★★	★★★★★	★★★★★
scalability	★	★	★★★★★	★★★	★★★★	★★★★★
elasticity	★	★	★★★★	★★	★★★	★★★★★
simplicity	★★★★★	★★★★	★	★★★	★	★
fault-tolerance	★	★	★★★★★	★★★★	★★★★★	★★★
evolvability	★	★★★	★★★★★	★★★★	★★★★★	★★★
total cost	★★★★★	★★★★★	★	★★★★	★★★	★★

monoliths



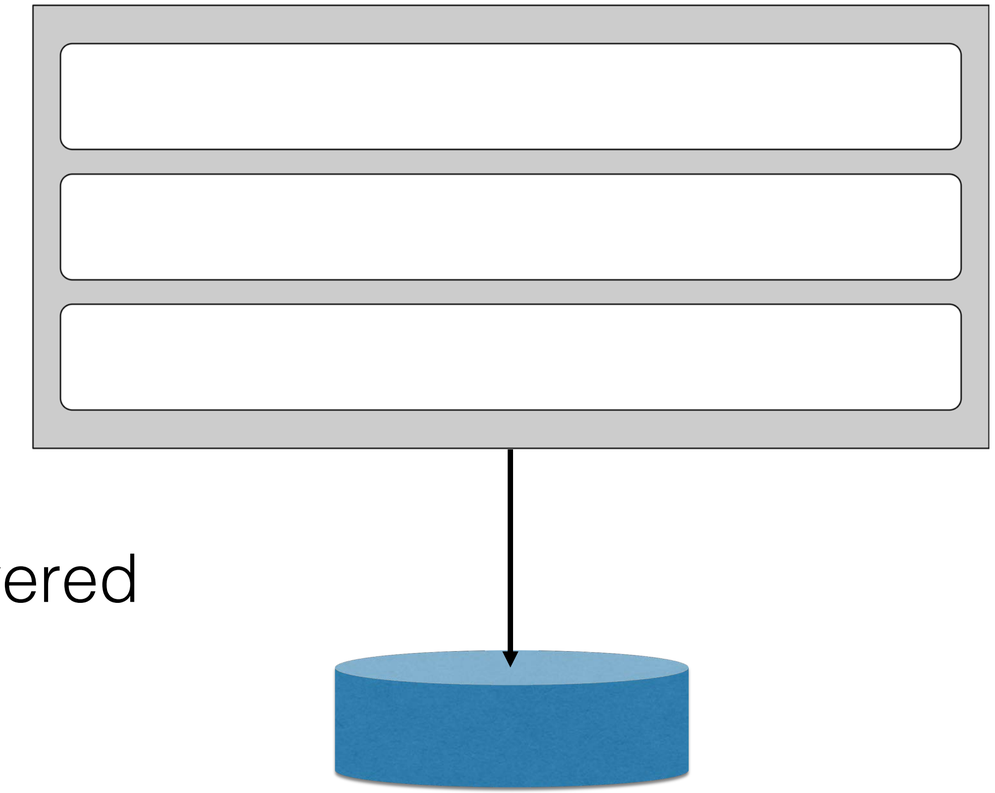
layered



modular

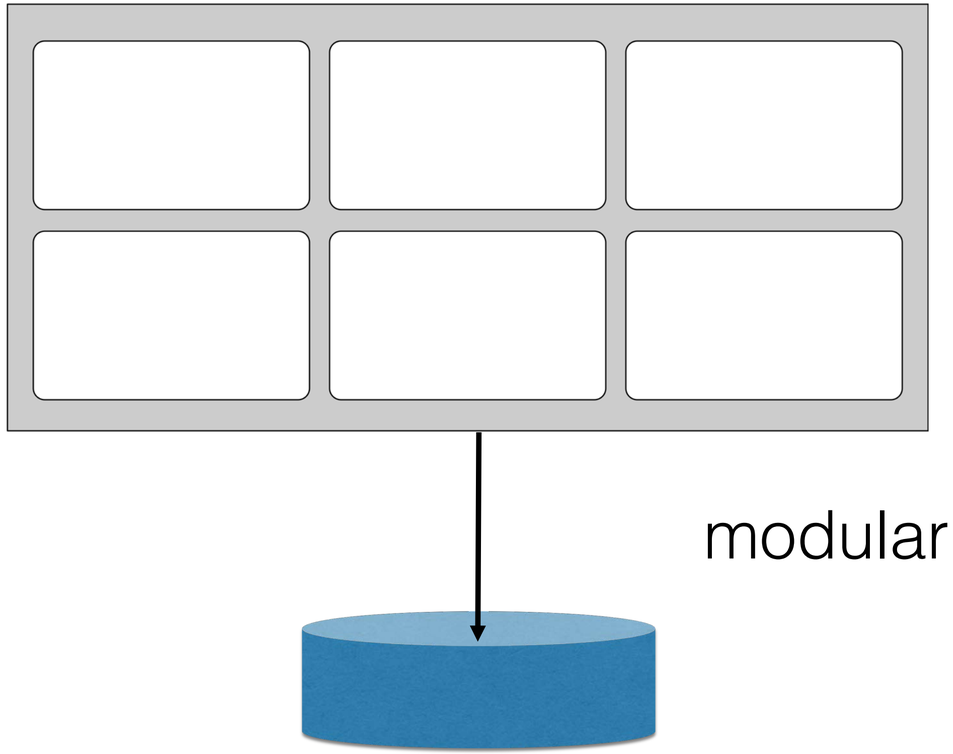
monoliths

technical partitioning



layered

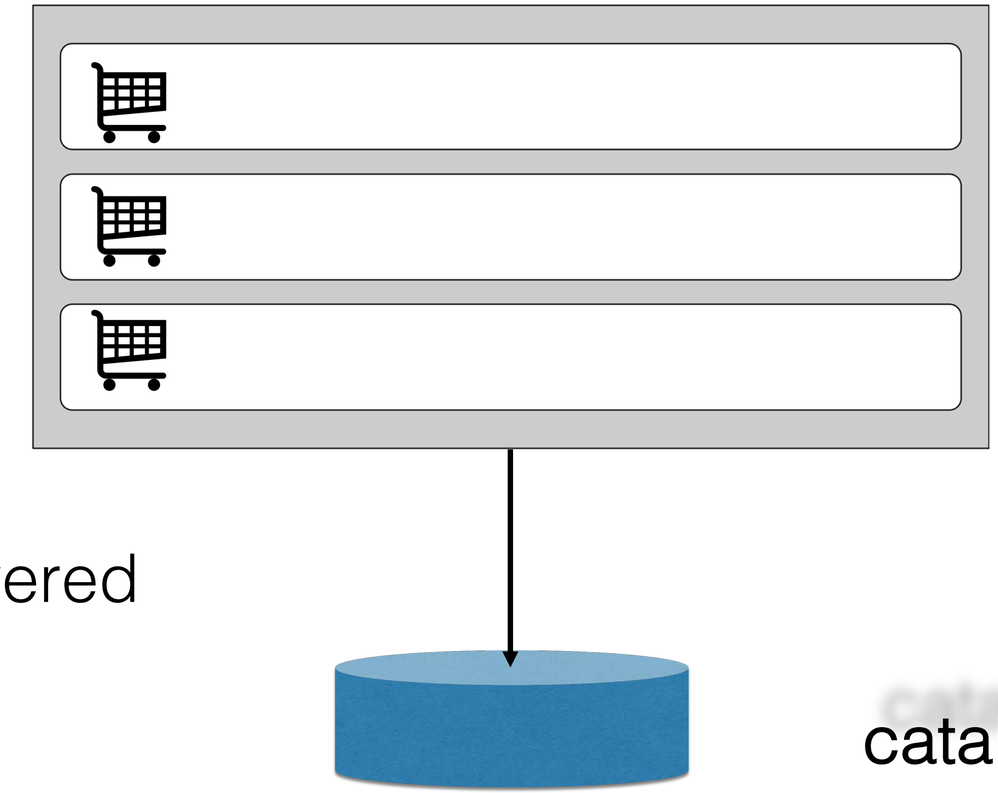
domain partitioning



modular

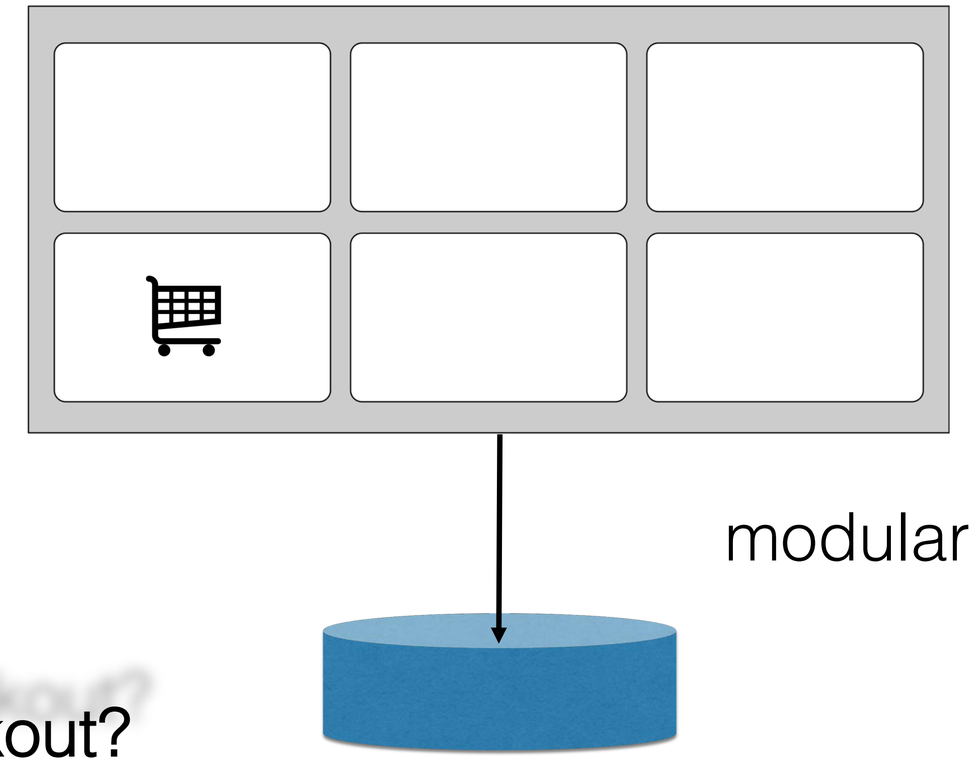
monoliths

technical partitioning



layered

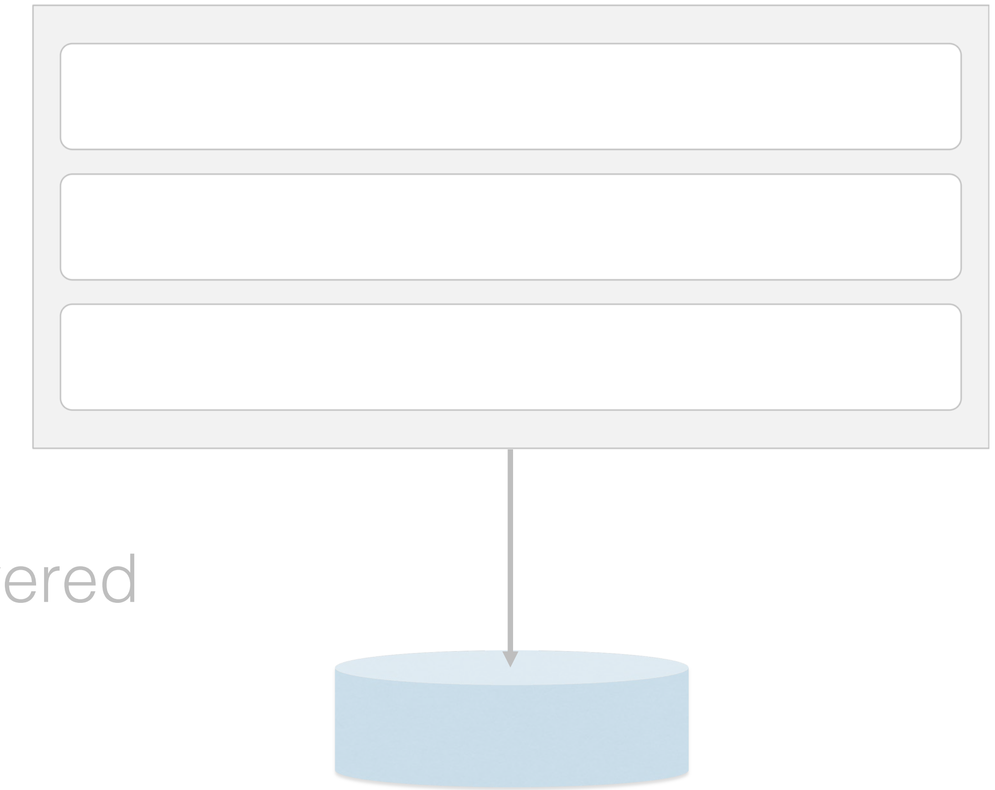
domain partitioning



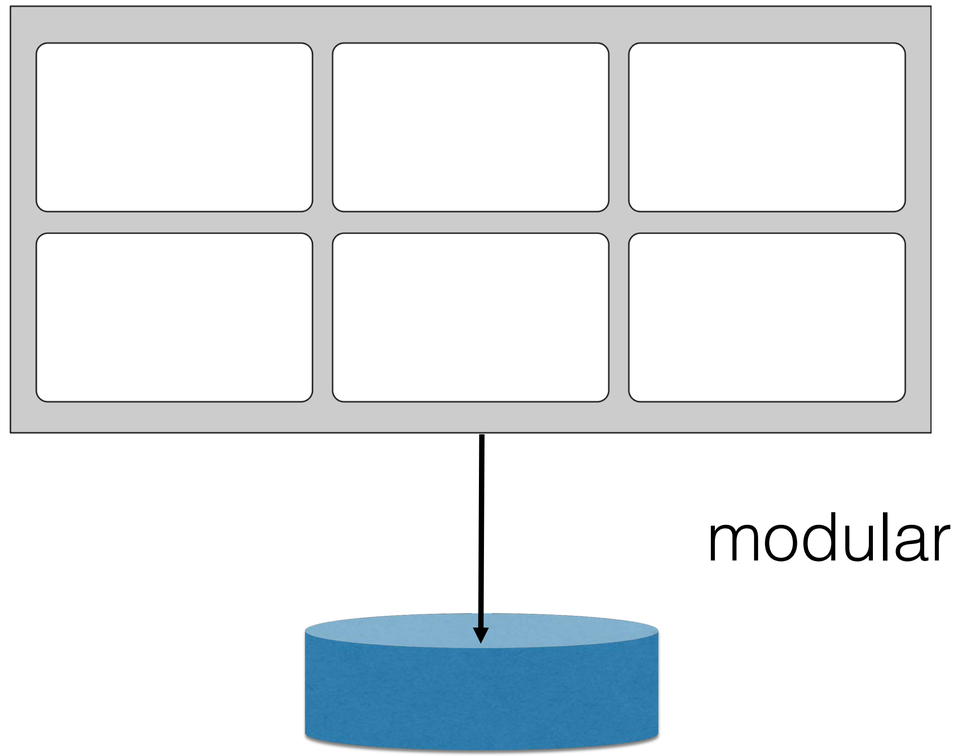
modular

catalog checkout?

monoliths

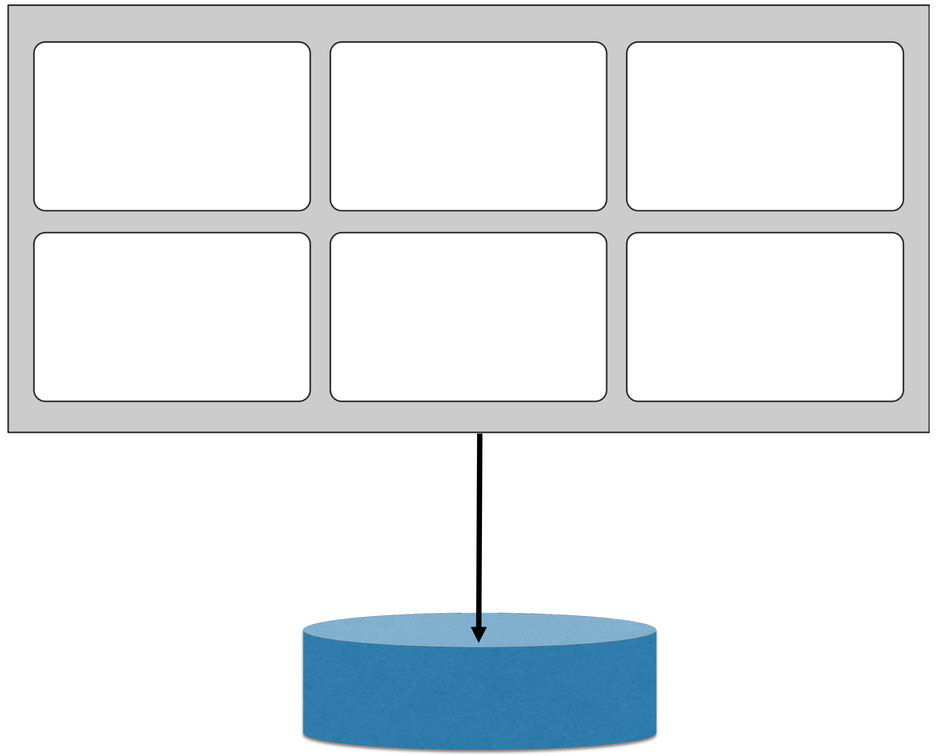


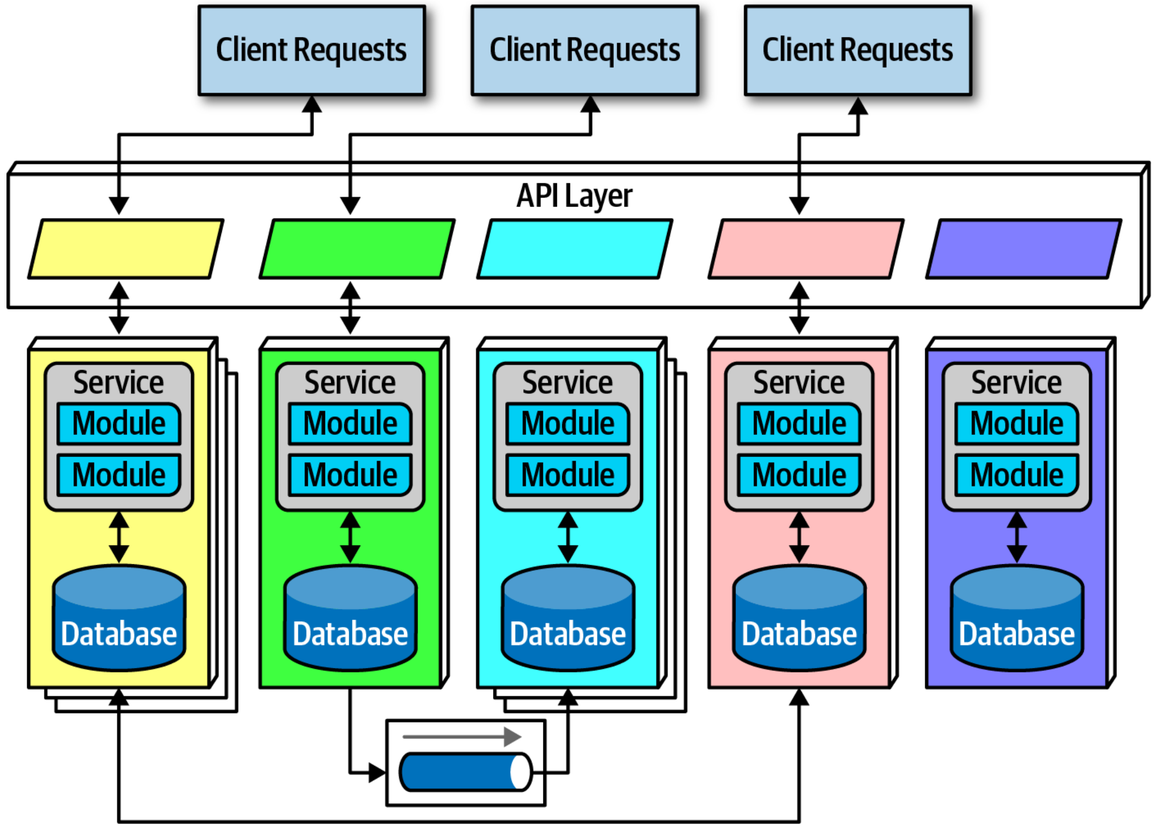
layered



modular

modular monoliths —> microservices

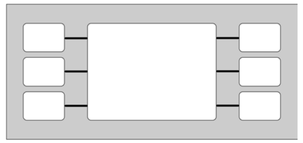




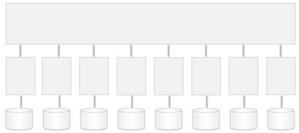
Your Architectural Kata is...

Silicon Sandwiches

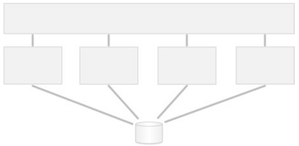
modular monolith



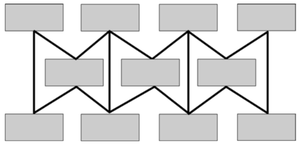
microkernel



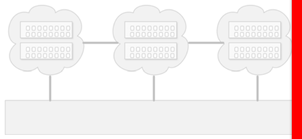
microservices



service-based



event-driven

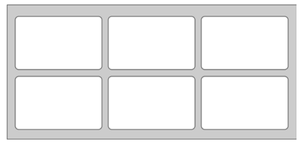


space-based

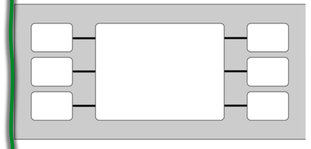
	modular monolith	microkernel	microservices	service-based	event-driven	space-based
agility	★	★★★	★★★★★	★★★★	★★★★	★★★
deployment	★	★★★	★★★★★	★★★★	★★★	★★★
testability	★★	★★★	★★★★★	★★★★	★★	★
performance	★★★	★★★	★★	★★★	★★★★★	★★★★★
scalability	★	★	★★★★★	★★★	★★★★	★★★★★
elasticity	★	★	★★★★	★★	★★★	★★★★★
simplicity	★★★★★	★★★★	★	★★★	★	★
fault-tolerance	★	★	★★★★★	★★★★	★★★★★	★★★
evolvability	★	★★★	★★★★★	★★★★	★★★★★	★★★
total cost	★★★★★	★★★★★	★	★★★★	★★★	★★

Your Architectural Kata is...

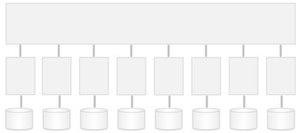
Silicon Sandwiches



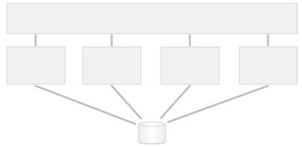
modular monolith



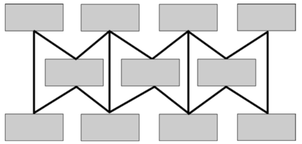
microkernel



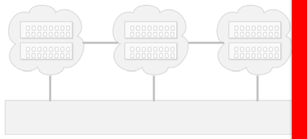
microservices



service-based



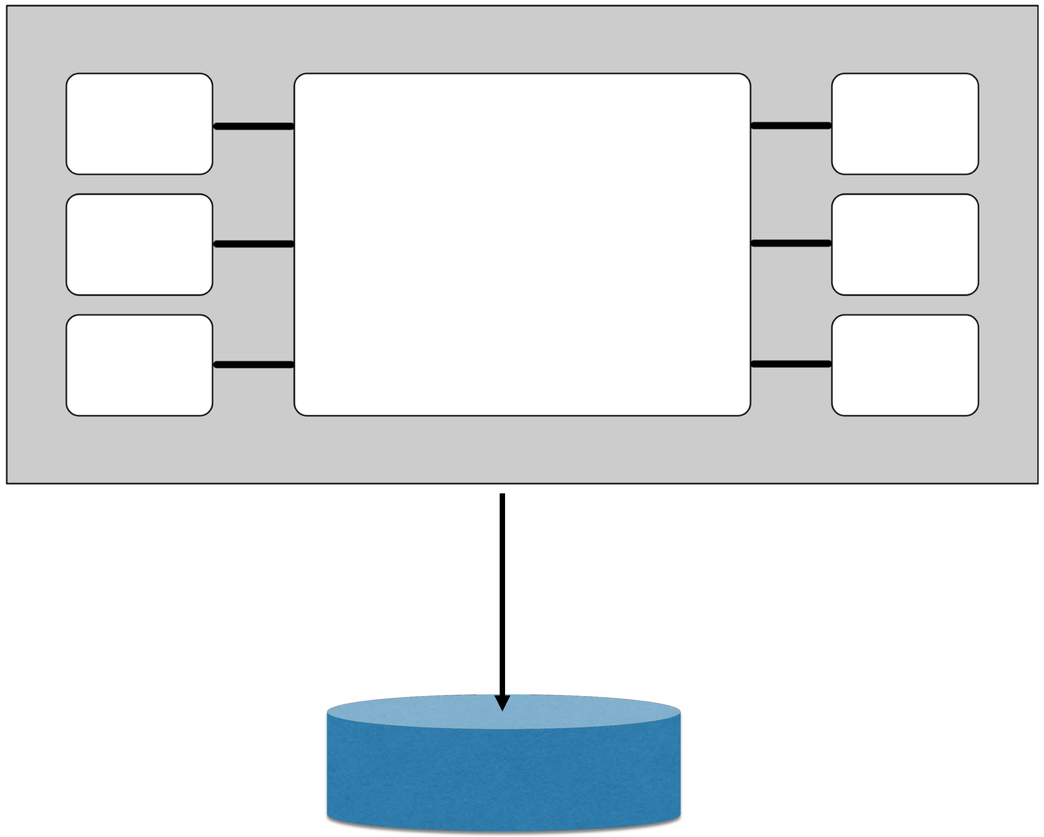
event-driven

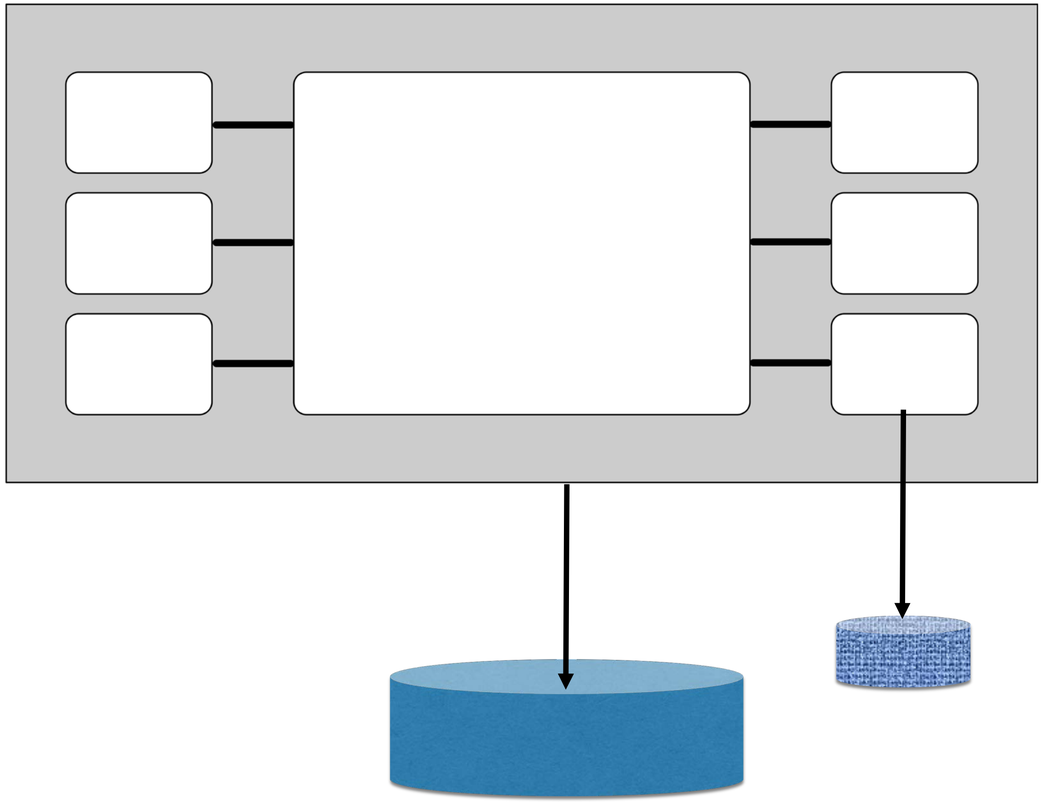


space-based

	modular monolith	microkernel	microservices	service-based	event-driven	space-based
agility	★	★★★	★★★★★	★★★★	★★★★	★★★
deployment	★	★★★	★★★★★	★★★★	★★★	★★★
testability	★★	★★★	★★★★★	★★★★	★★	★
performance	★★★	★★★	★★	★★★	★★★★★	★★★★★
scalability	★	★	★★★★★	★★★	★★★★	★★★★★
elasticity	★	★	★★★★	★★	★★★	★★★★★
simplicity	★★★★★	★★★★	★	★★★	★	★
fault-tolerance	★	★	★★★★★	★★★★	★★★★★	★★★
evolvability	★	★★★	★★★★	★★★★	★★★★★	★★★
total cost	★★★★★	★★★★★	★	★★★★	★★★	★★

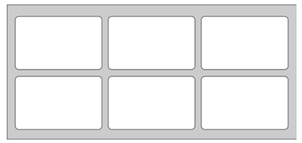
microkernel



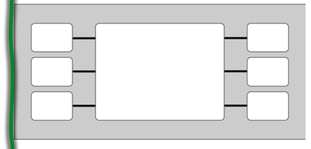


Your Architectural Kata is...

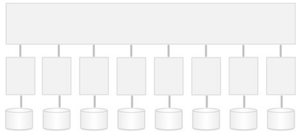
Silicon Sandwiches



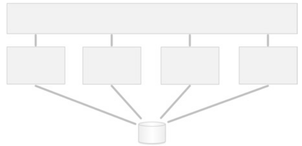
modular monolith



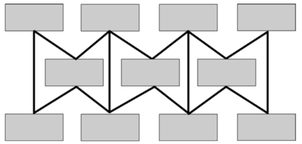
microkernel



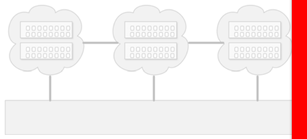
microservices



service-based



event-driven

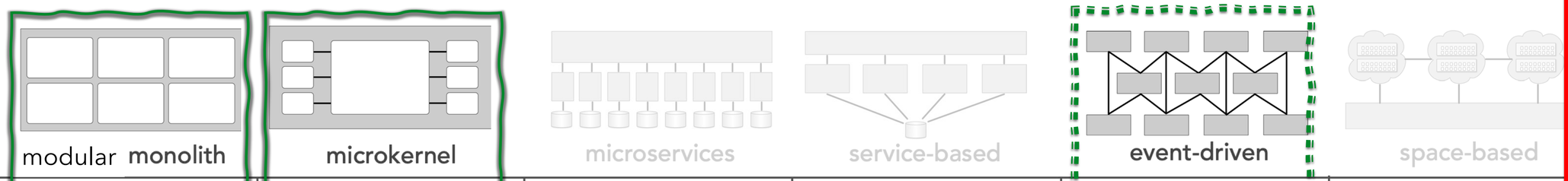


space-based

	modular monolith	microkernel	microservices	service-based	event-driven	space-based
agility	★	★★★	★★★★★	★★★★	★★★★	★★★
deployment	★	★★★	★★★★★	★★★★	★★★	★★★
testability	★★	★★★	★★★★★	★★★★	★★	★
performance	★★★	★★★	★★	★★★	★★★★★	★★★★★
scalability	★	★	★★★★★	★★★	★★★★	★★★★★
elasticity	★	★	★★★★	★★	★★★	★★★★★
simplicity	★★★★★	★★★★	★	★★★	★	★
fault-tolerance	★	★	★★★★★	★★★★	★★★★★	★★★
evolvability	★	★★★	★★★★	★★★★	★★★★★	★★★
total cost	★★★★★	★★★★★	★	★★★★	★★★	★★

Your Architectural Kata is...

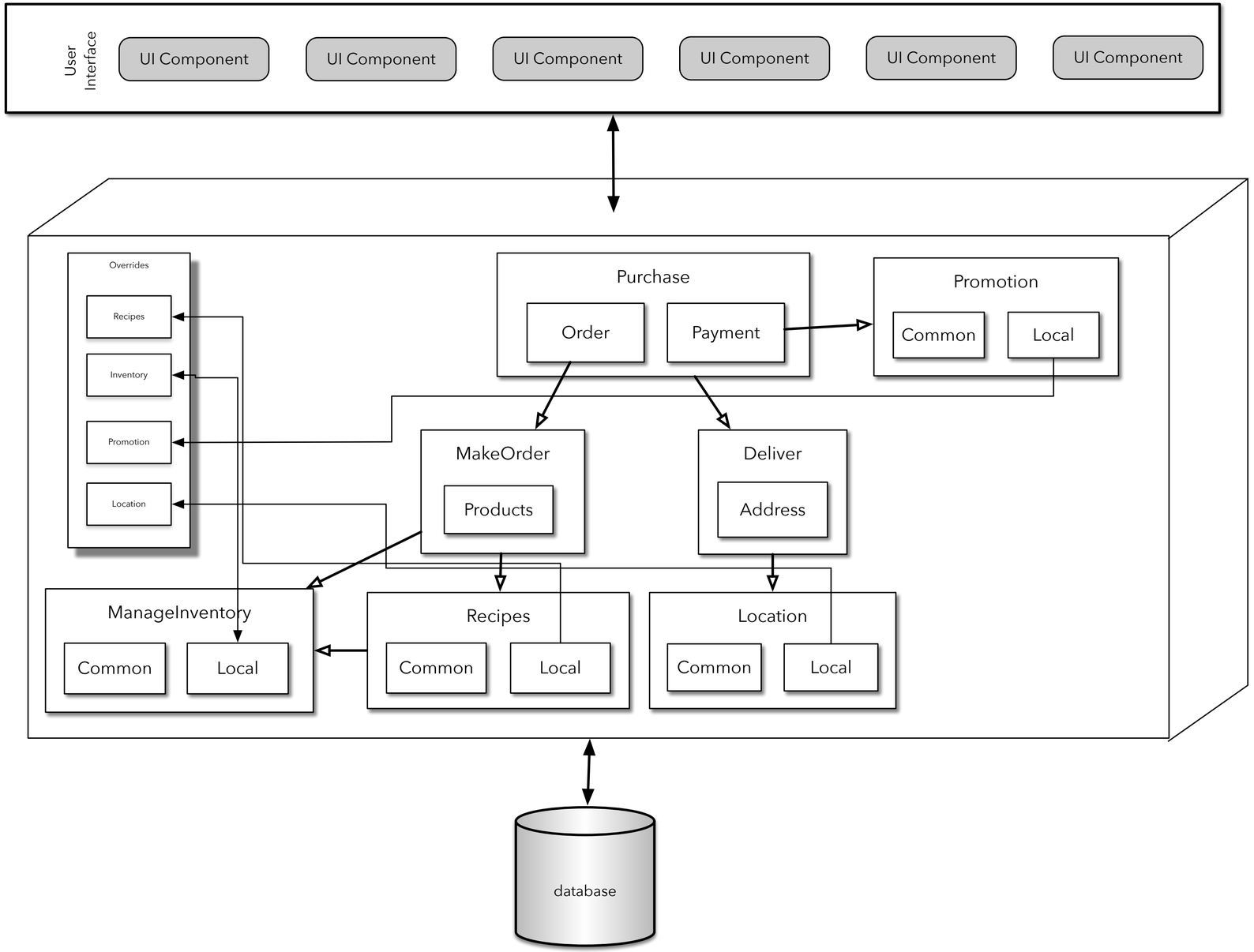
Silicon Sandwiches



	modular monolith	microkernel	microservices	service-based	event-driven	space-based
agility	★	★★★	★★★★★	★★★★	★★★★	★★★
deployment	★	★★★	★★★★★	★★★★	★★★	★★★
testability	★★	★★★	★★★★★	★★★★	★★	★
performance	★★★	★★★	★★	★★★	★★★★★	★★★★★
scalability	★	★	★★★★★	★★★	★★★★	★★★★★
elasticity	★	★	★★★★	★★	★★★	★★★★★
simplicity	★★★★★	★★★★	★	★★★	★	★
fault-tolerance	★	★	★★★★★	★★★★	★★★★★	★★★
evolvability	★	★★★	★★★★	★★★★	★★★★★	★★★
total cost	★★★★★	★★★★★	★	★★★★	★★★	★★

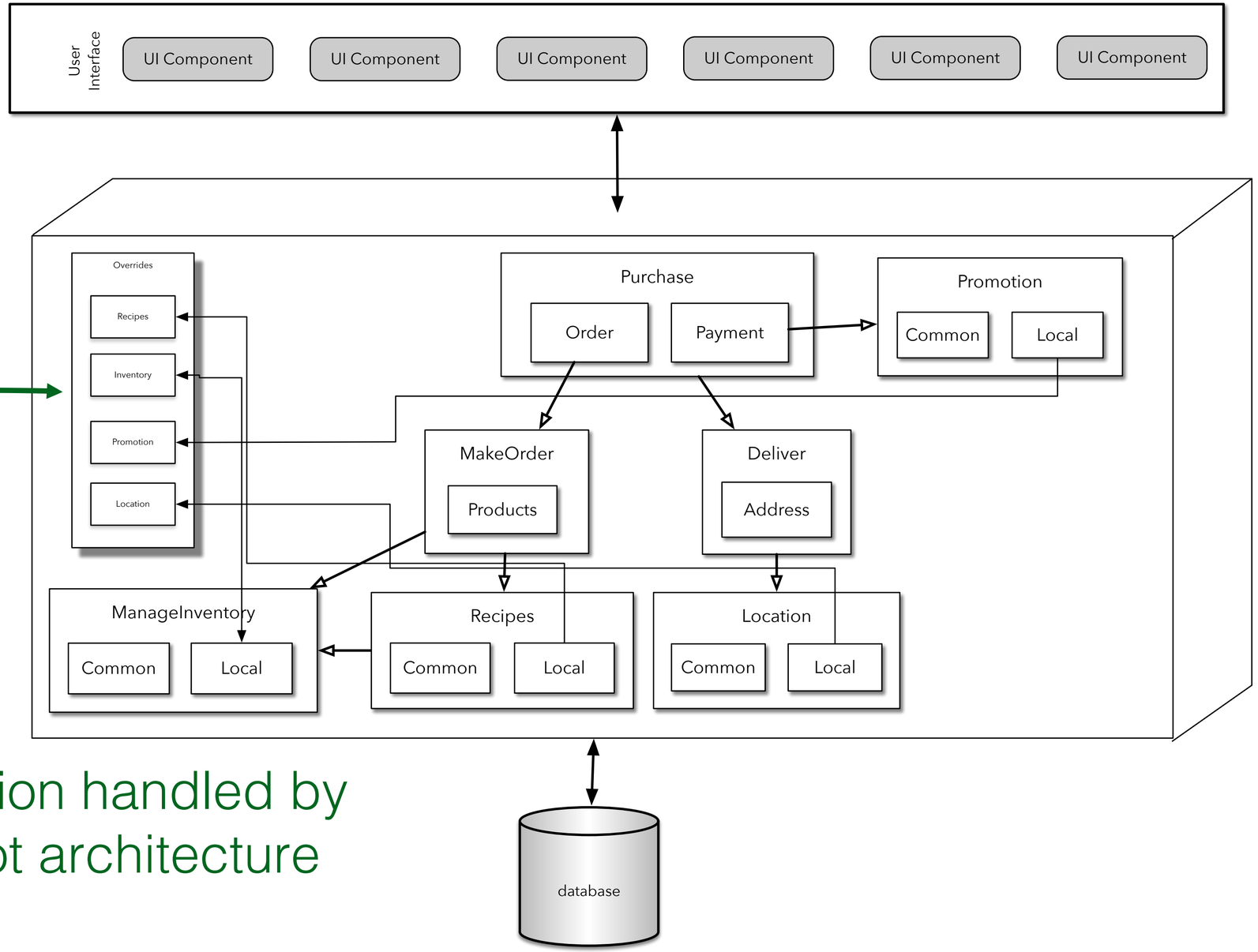
Your Architectural Kata is...

Silicon Sandwiches



Your Architectural Kata is...

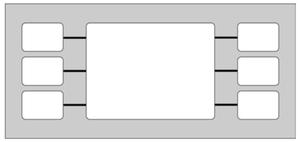
Silicon Sandwiches

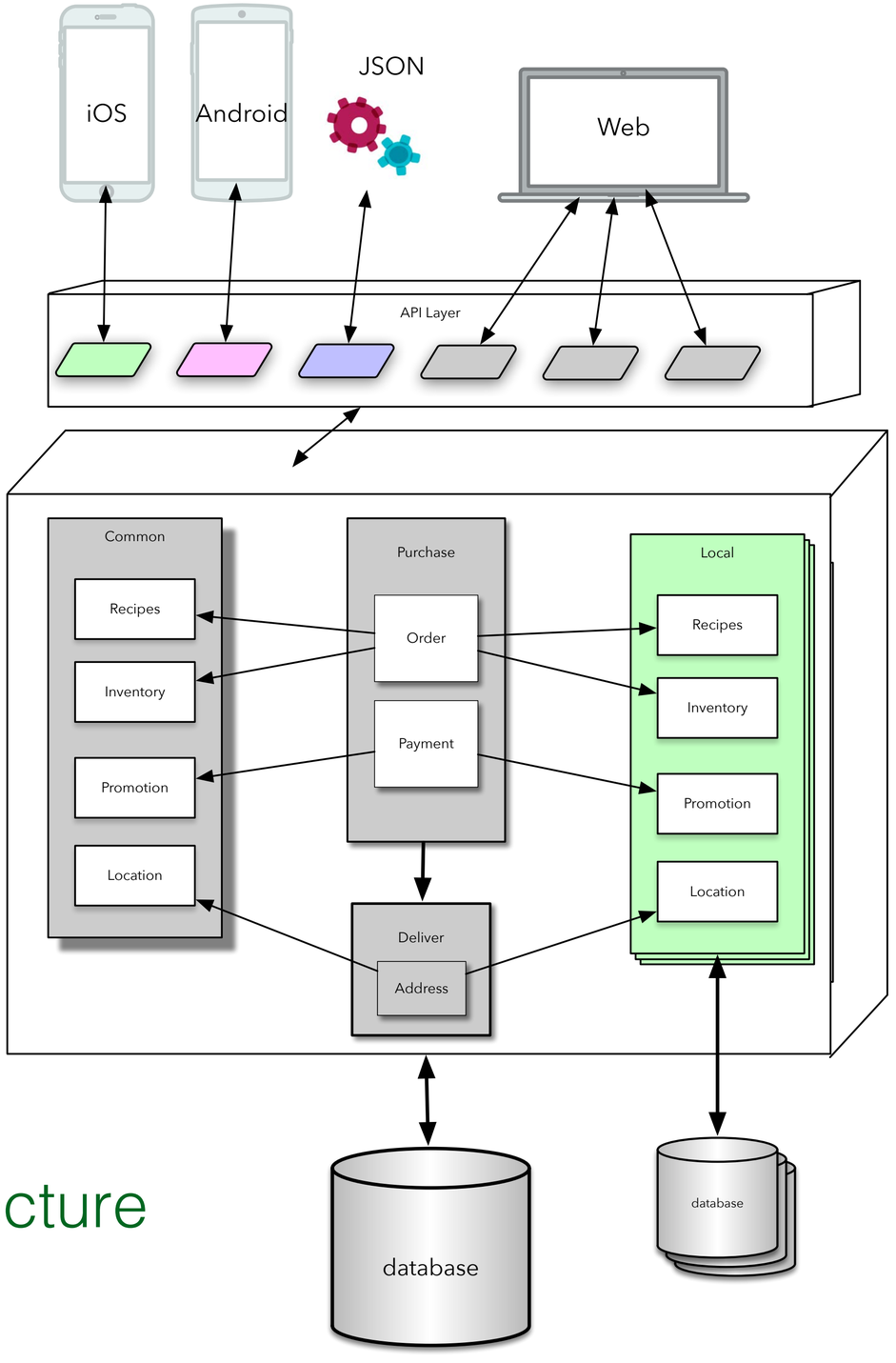


Customization handled by design, not architecture

Your Architectural Kata is...

Silicon Sandwiches



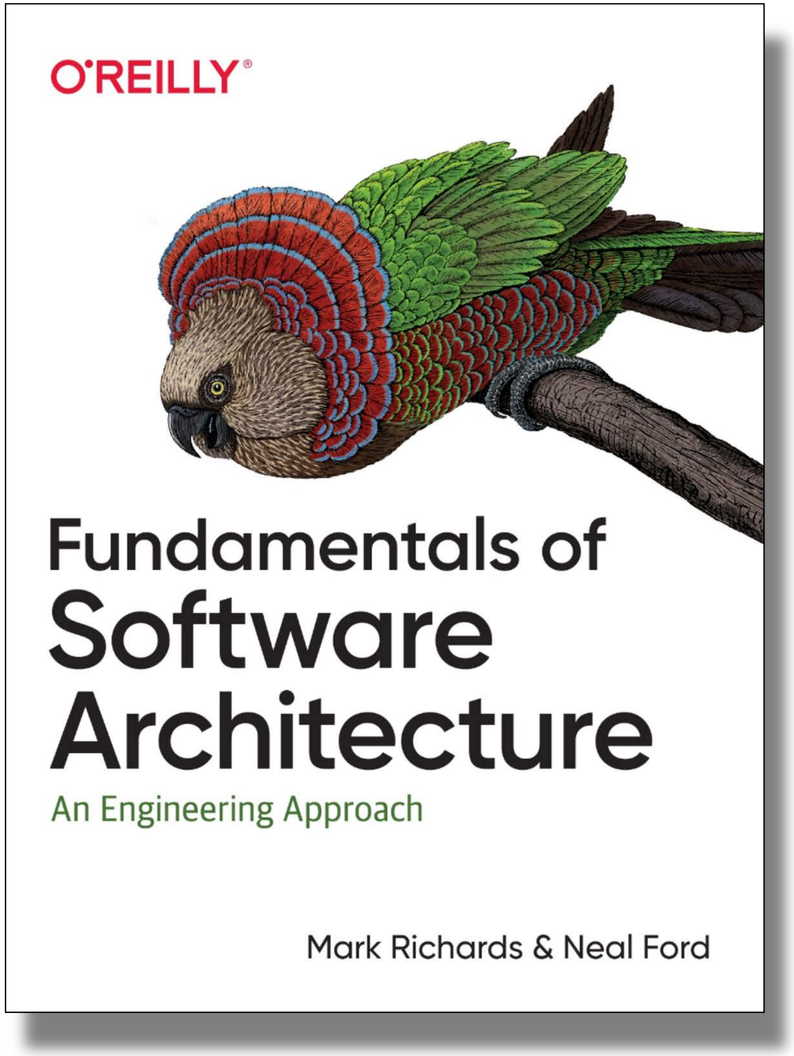


Customization handled by architecture

documenting software architecture

documenting software architecture

documenting software architecture



Second Law of Software Architecture

"Why is more important than how"

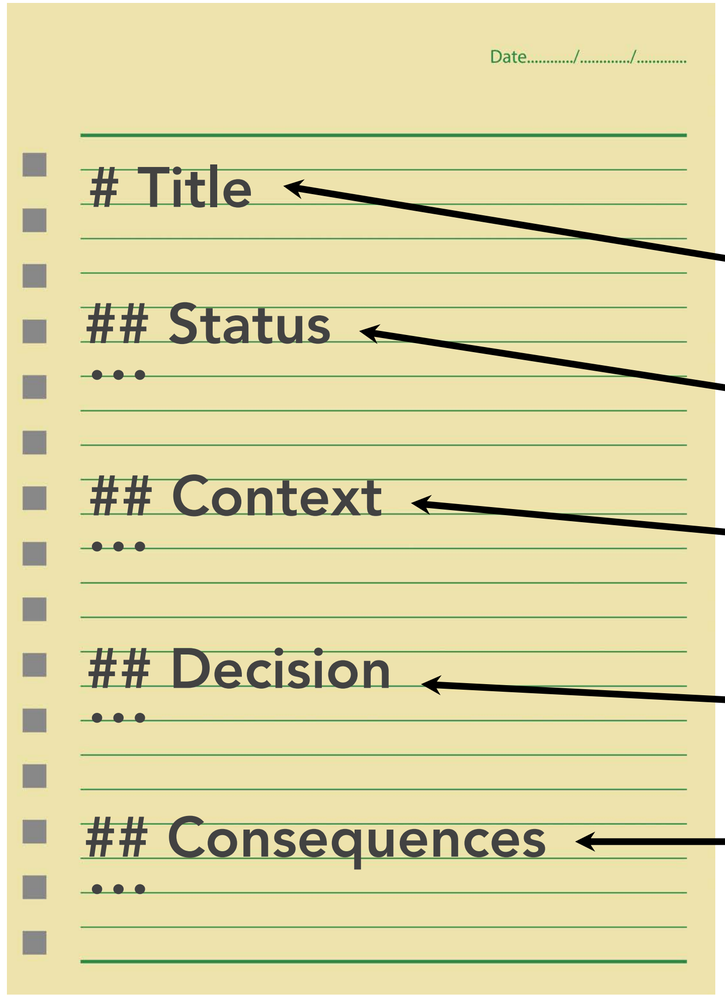
documenting software architecture

"We will keep a collection of records for *architecturally significant decisions*: those that affect the structure, non-functional characteristics, dependencies, interfaces, or construction techniques."

- Michael Nygard

http://thinkrelevance.com/blog/2011/11/15/documenting-architecture-decisions

documenting software architecture



short text file; 1-2 pages long, one file per decision
markdown, textile, asciidoc, plaintext, etc.

short noun phrase

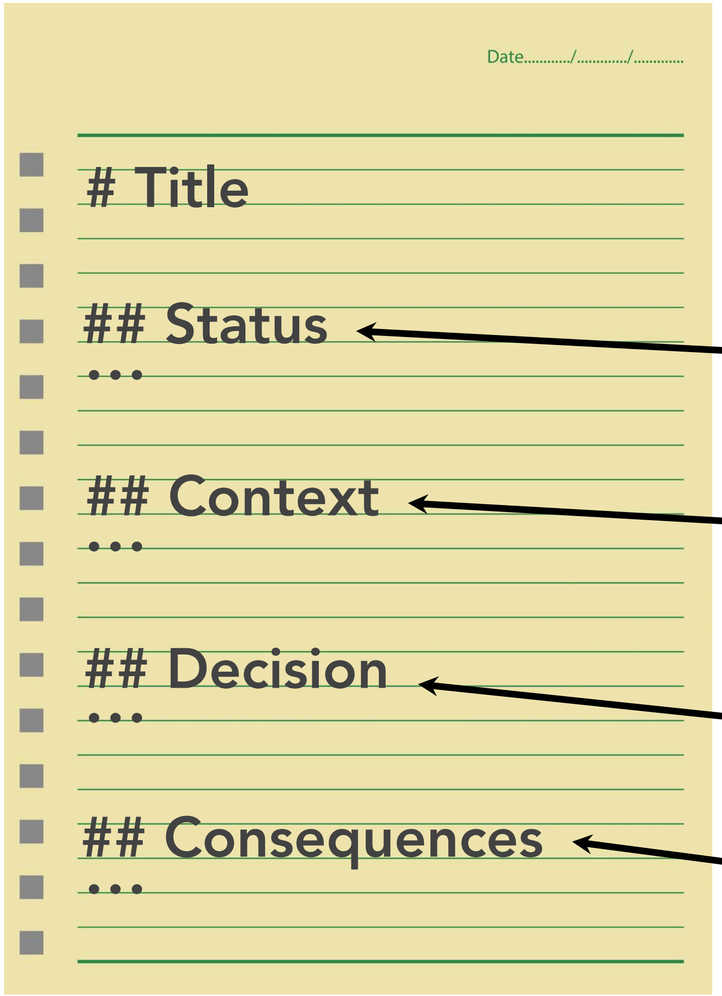
proposed, accepted, superseded

forces at play

response to forces

context after decision is applied

documenting software architecture



short text file; 1-2 pages long, one file per decision
markdown, textile, asciidoc, plaintext, etc.

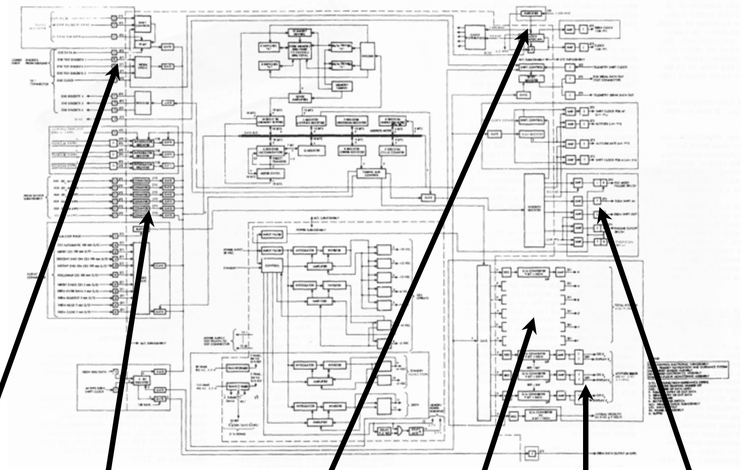
forces criteria for knowing when an architect must seek approval for a decision

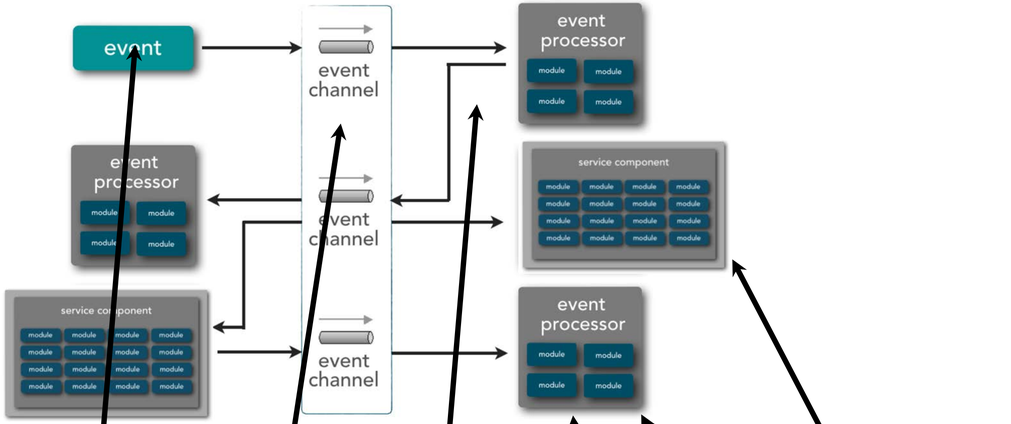
description of the problem and alternative solutions available (documentation)

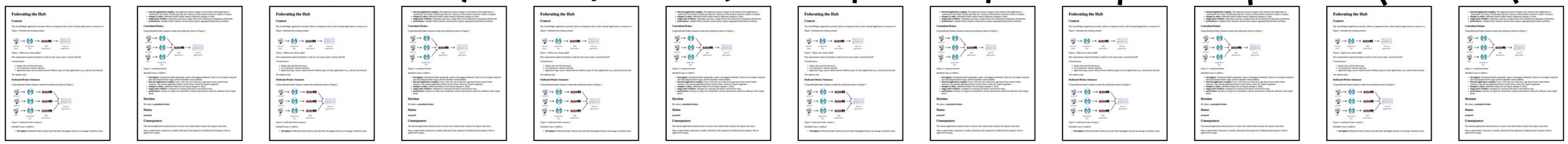
justification (the “why”)

tradeoffs and impact of decision

documenting software architecture







Your Architectural Kata is...

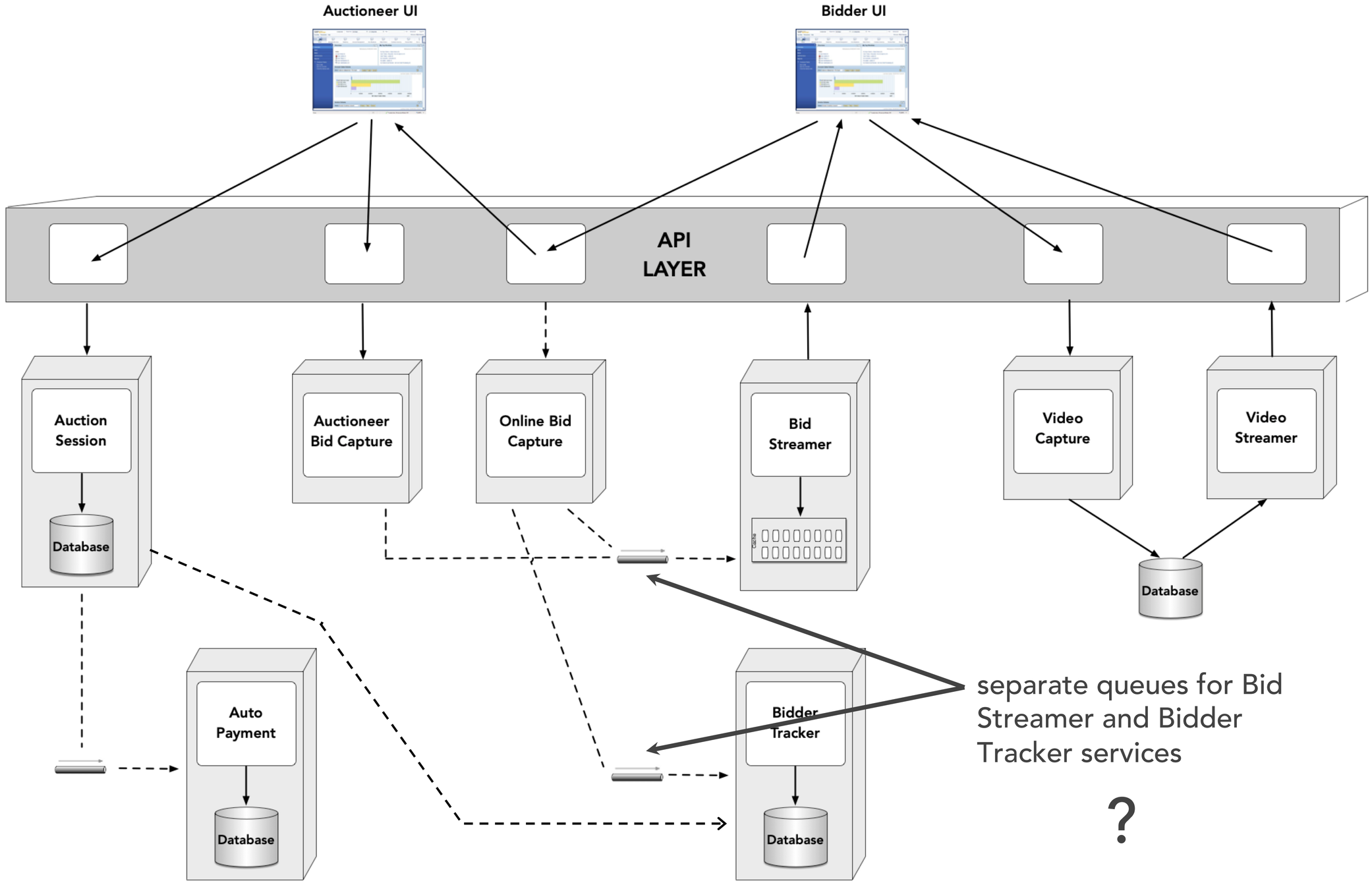
Going Going Gone!

An auction company wants to take their auctions online to a nationwide scale--customers choose the auction to participate in, wait until the auction begins, then bid during the live auction as if they were there in the room, with the auctioneer.

- **Users**: scale up to hundreds of participants (per auction), potentially up to thousands of participants, and as many simultaneous auctions as possible
- **Requirements**:
  - bidders can see a live video stream of the auction and see all bids as they occur
  - auctions must be as real-time as possible
  - both online and live bids must be received in the order in which they are placed
  - bidders register with credit card; system automatically charges card if bidder wins
  - participants must be tracked via a reputation index
- **Additional Context:**
  - auction company is expanding aggressively by merging with smaller competitors
  - if nationwide auction is a success, replicate the model overseas
  - budget is not constrained--this is a strategic direction
  - company just exited a lawsuit where they settled a suit alleging fraud

Your Architectural Kata is...

Going Going Gone!



1. Separate Queues for Bid Streamer and Tracker Services

Status

Accepted

Context

The Bid Capture Services, upon receiving a bid, must forward that bid to the Bid Streamer Service and the Bidder Tracker Service. This could be done using a single topic (pub/sub) or separate queues (p2p) for each service.

Decision

We will use separate queues for the Bid Streamer and Bidder Tracker services.

Multiple bids will come in for the same ask amount. The Streamer service only needs the first bid received for that amount, whereas the Bidder Tracker needs all bids received. Using a topic (pub/sub) would require the Bid Streamer to contain logic to ignore bids that are the same as the prior amount, forcing the Bid Streamer to store shared state between instances.

The Bid Streamer Service stores the bids for an item in an in-memory cache, whereas the Bidder Tracker stored bids in a database. The Bidder Tracker will therefore be slower and might require back pressure. Using a dedicated Bidder Tracker queue provides this dedicated back pressure point.

Consequences

This decision will require the Bid Capture services to send the same information to multiple queues.

Use of Micro-kernel Architecture

Status
PROPOSED

Context
Two key requirements of the system (_promotions_ anc quirements.

The current design features a modular monolith archite e 1_.

![modular monolith](fig1_modular_monolith.jpg)
Figure 1: the current state architecture

Currently, stores must specify custom behavior (produc FTP. Operations must certify the JAR, leading to dela

All local customizations reside in one service and in one ecome a tangled mess.

To allow stores to most easily add and customize local 2_.

![microkernel architecture](fig2_microkernel.jpg)
Figure 2: proposed microkernel architecture

The new design allows easy update of global policy (pr n appropriate.

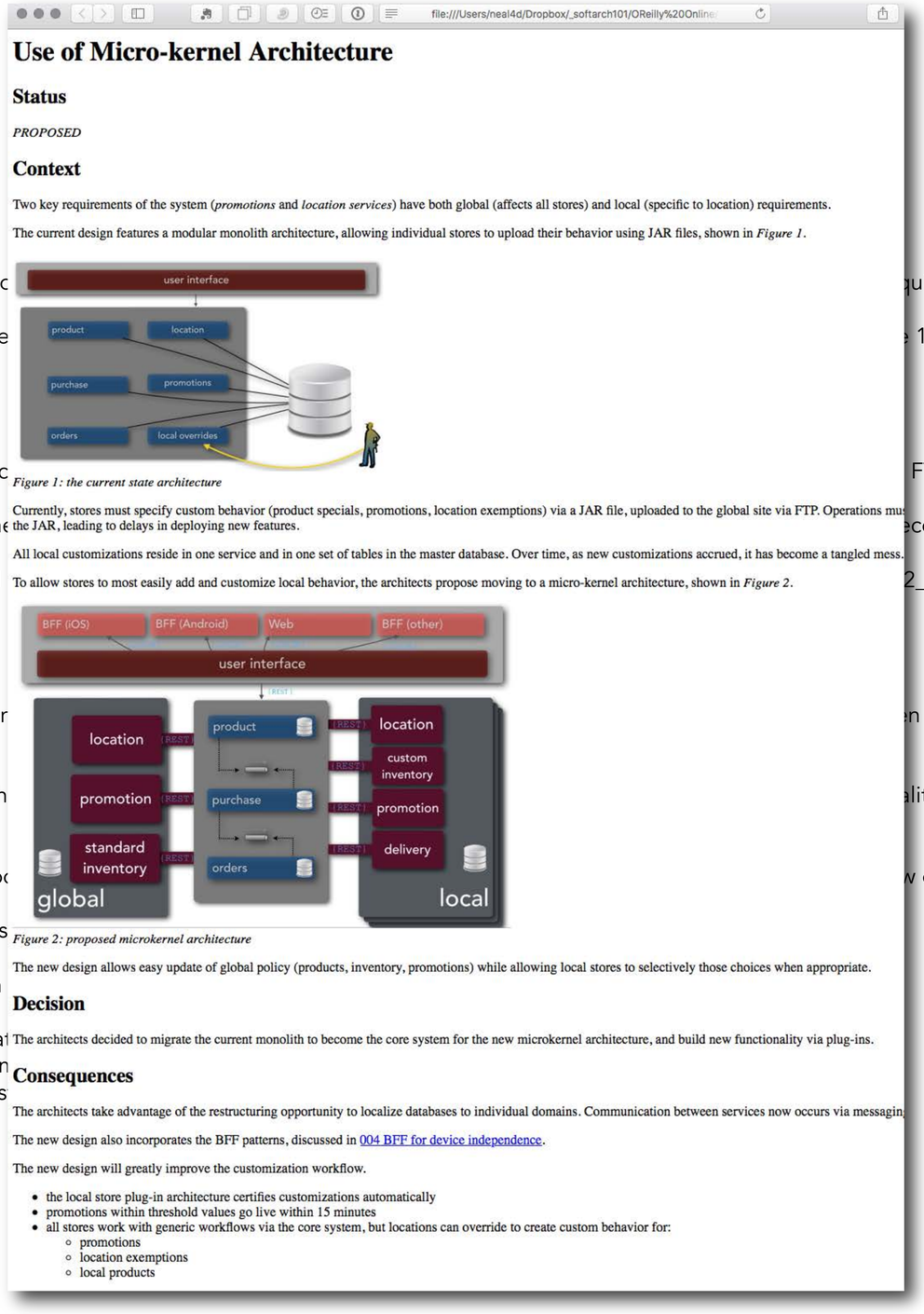
Decision
The architects decided to migrate the current monolith ality via plug-ins.

Consequences
The architects take advantage of the restructuring oppo w occurs via messaging.

The new design also incorporates the BFF patterns, dis

The new design will greatly improve the customization

- the local store plug-in architecture certifies customizat
- promotions within threshold values go live within 15 n
- all stores work with generic workflows via the core sys
  - promotions
  - location exemptions
  - local products



Use of Micro-kernel Architecture

Status

PROPOSED

Context

Two key requirements of the system (*promotions* and *location services*) have both global (affects all stores) and local (specific to location) requirements.

The current design features a modular monolith architecture, allowing individual stores to upload their behavior using JAR files, shown in *Figure 1*.

Figure 1: the current state architecture

Currently, stores must specify custom behavior (product specials, promotions, location exemptions) via a JAR file, uploaded to the global site via FTP. Operations mus
the JAR, leading to delays in deploying new features.

All local customizations reside in one service and in one set of tables in the master database. Over time, as new customizations accrued, it has become a tangled mess.

To allow stores to most easily add and customize local behavior, the architects propose moving to a micro-kernel architecture, shown in *Figure 2*.

Figure 2: proposed microkernel architecture

The new design allows easy update of global policy (products, inventory, promotions) while allowing local stores to selectively those choices when appropriate.

Decision

The architects decided to migrate the current monolith to become the core system for the new microkernel architecture, and build new functionality via plug-ins.

Consequences

The architects take advantage of the restructuring opportunity to localize databases to individual domains. Communication between services now occurs via messagin

The new design also incorporates the BFF patterns, discussed in 004 BFF for device independence.

The new design will greatly improve the customization workflow.

- the local store plug-in architecture certifies customizations automatically
- promotions within threshold values go live within 15 minutes
- all stores work with generic workflows via the core system, but locations can override to create custom behavior for:
  - promotions
  - location exemptions
  - local products

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Use of Micro-kernel Architecture

Status

PROPOSED

Context

Two key requirements of the system (*promotions* and *location services*) have both global (affects all stores) and local (specific to location) requirements.

The current design features a modular monolith architecture, allowing individual stores to upload their behavior using JAR files, shown in *Figure 1*.

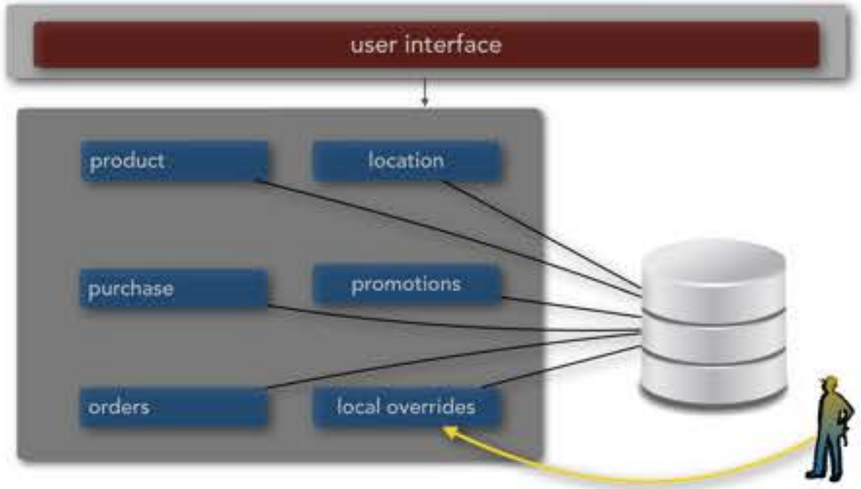

Figure 1: the current state architecture

Currently, stores must specify custom behavior (product specials, promotions, location exemptions) via a JAR file, uploaded to the global site via FTP. Operations n
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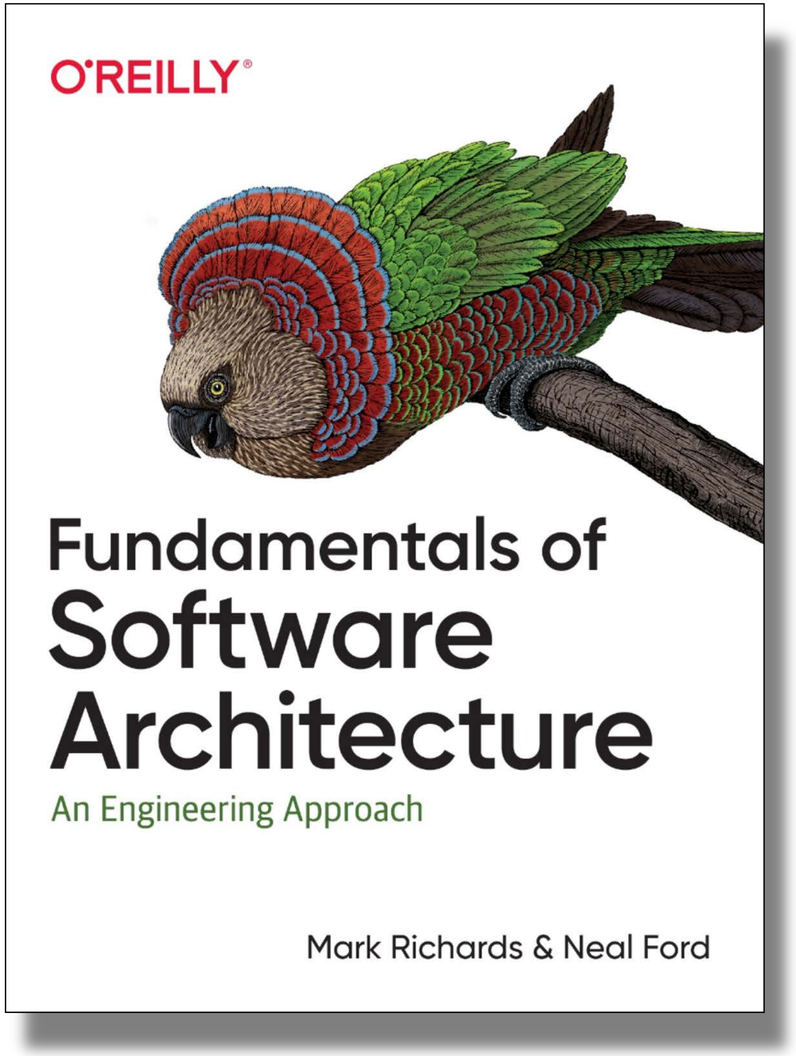
summary

summary

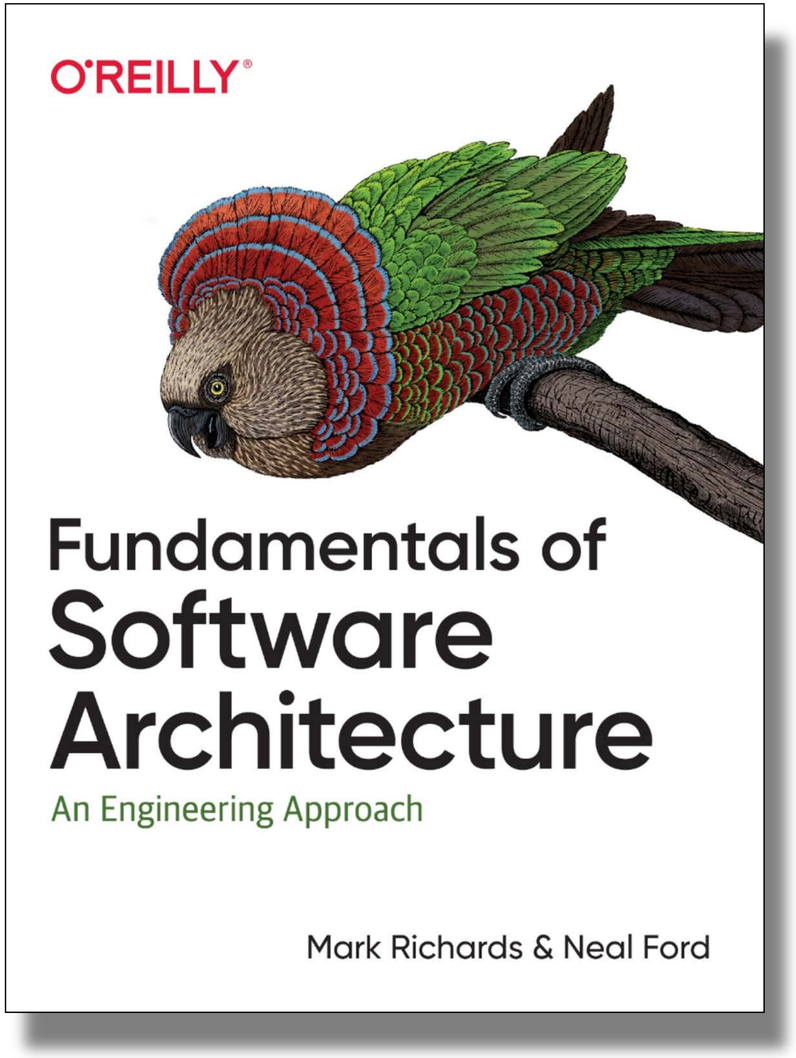


First Law of Software Architecture

"Everything in software architecture is a tradeoff"

There are no right or wrong answers in architecture; rather, it's always about ***tradeoffs***

summary



Second Law of Software Architecture

"Why is more important than how"

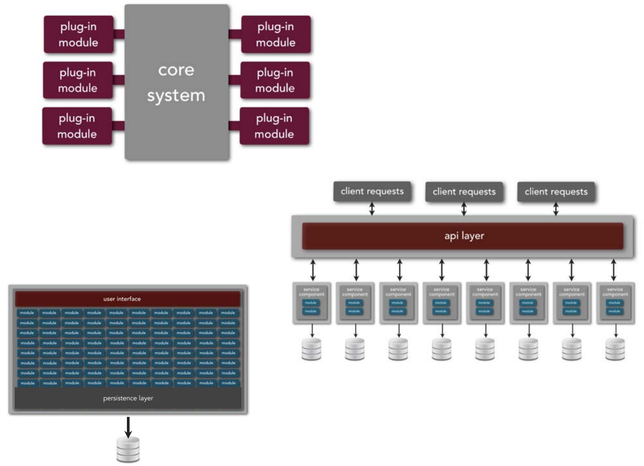
every architecture decision should be accompanied with a ***technical and business justification***

summary

scalability

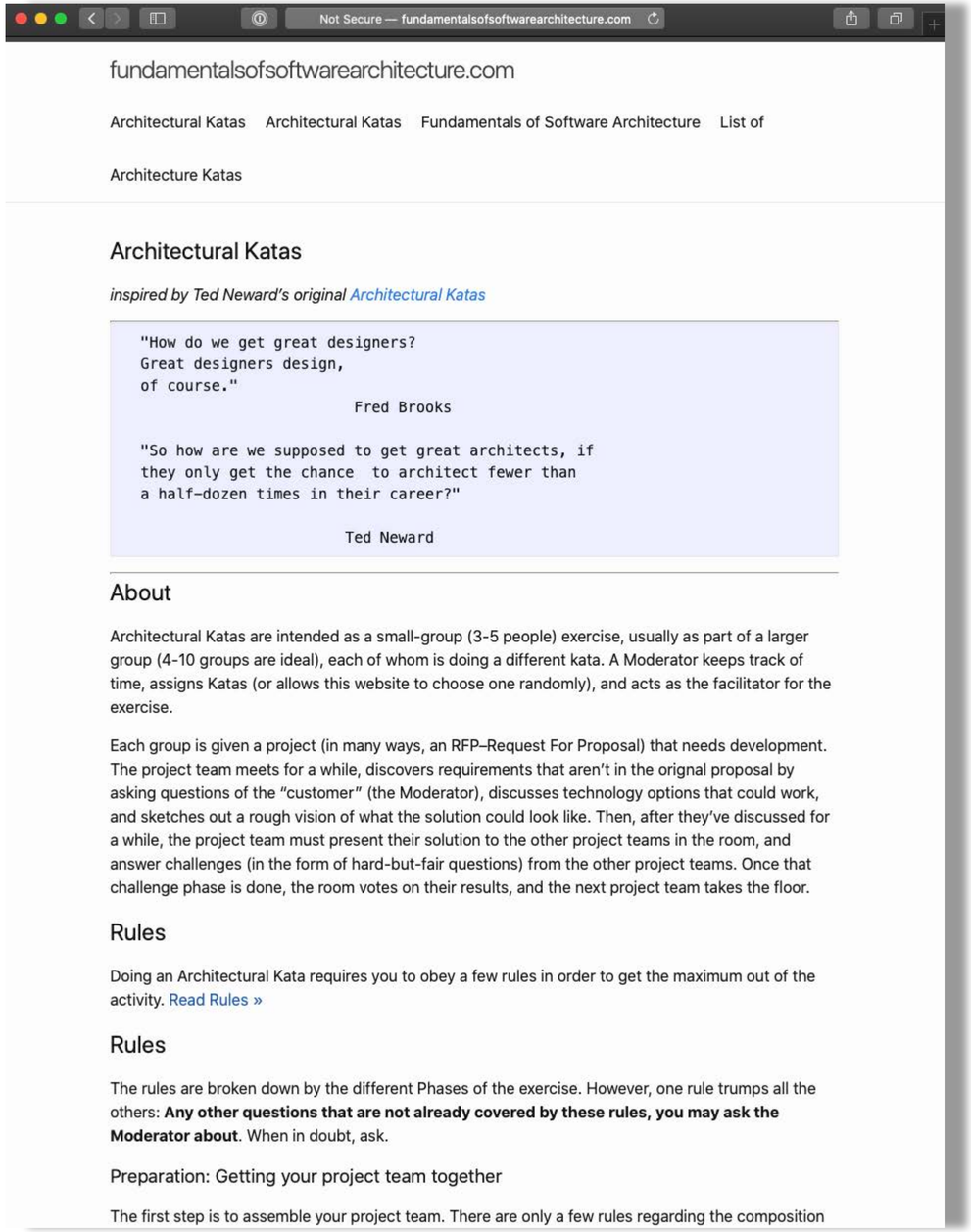
reliability

availability



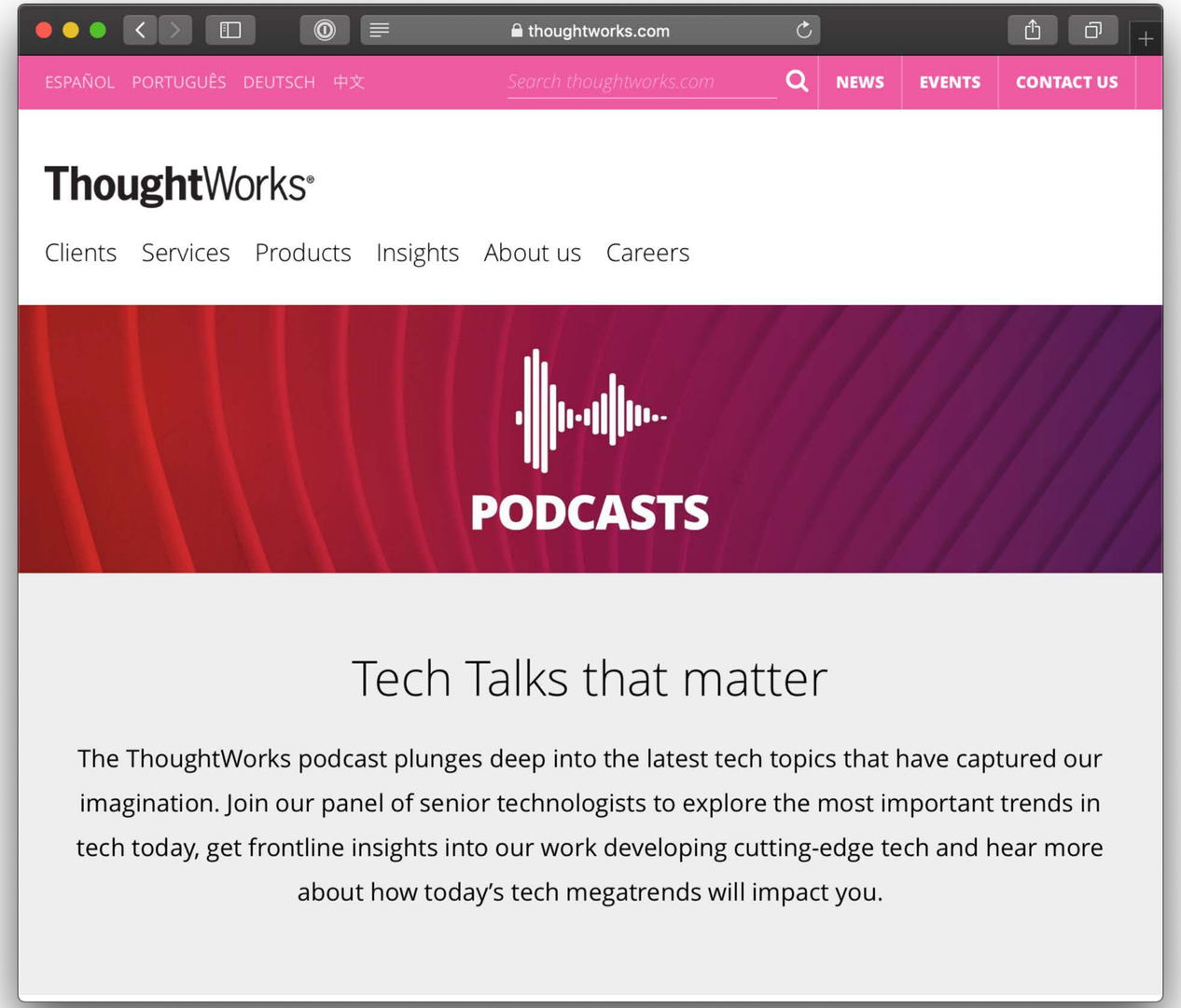
business needs and ***architectural characteristics*** are what drive the architecture!

more resources



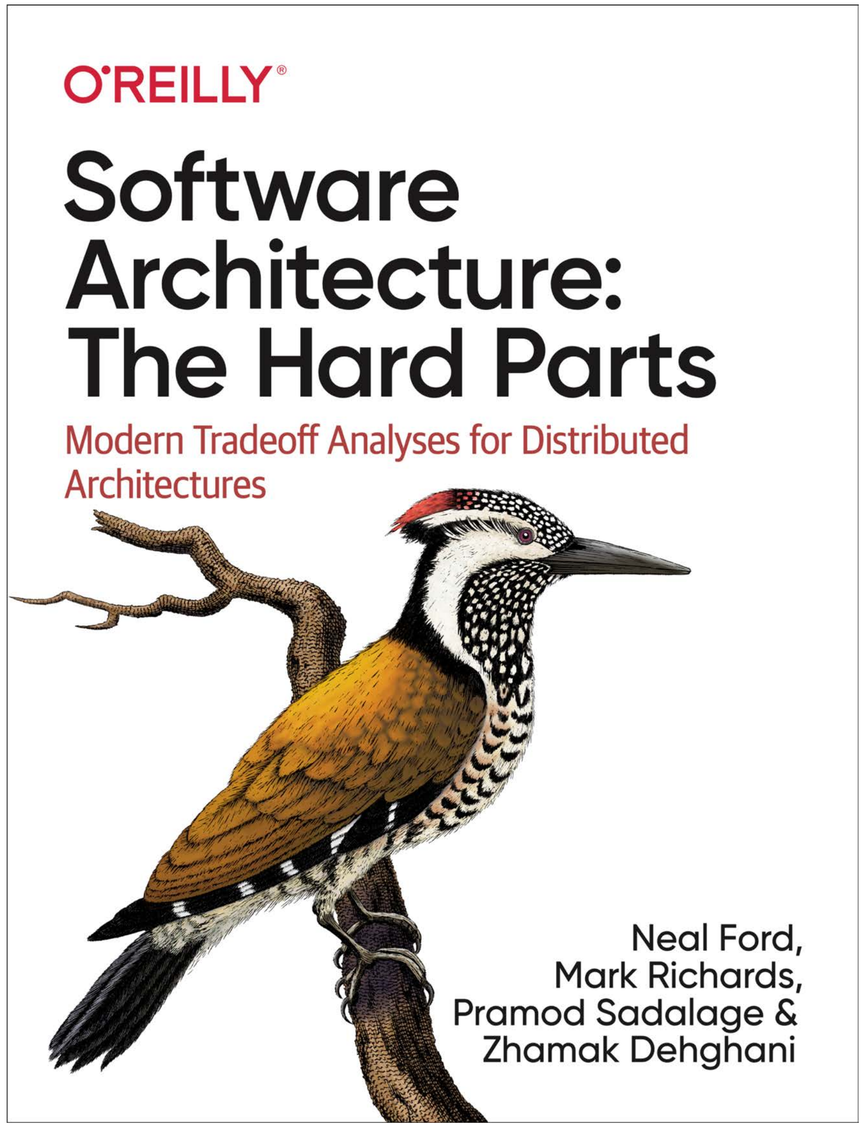
http://fundamentalsofsoftwarearchitecture.com/katas/

more resources



https://www.thoughtworks.com/podcasts

Coming soon…



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Architecture by Example

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